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SUTURES IN ANCIENT SURGERY

Fabricius

(1537-1619)

SUTUREGRAM

NUMBER NINE IN A SERIES

Complications of Suturing

Edges separate because . . .

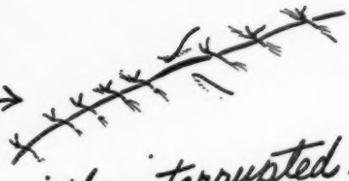
1. Suture cuts through tissue

Result of tight tying
Occurs after 3 or 4 days

2. Knots become untied

Result of failure to tie 3 square knots

3. Knot becomes untied at end of continuous suture



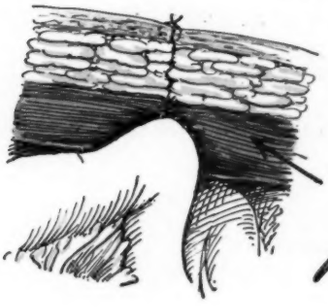
Cannot occur with interrupted sutures
If one knot becomes untied, rest remain tied and carry on intended function

SUTUREGRAM NUMBER NINE (CONTINUED)

Types of Wound Dehiscence

a) Separation of skin edges

b) Post-operative hernia



Anterior sheath remains sutured and heals

Posterior sheath and peritoneum separate

c) Evisceration
All layers separate to the skin.

(To be continued)

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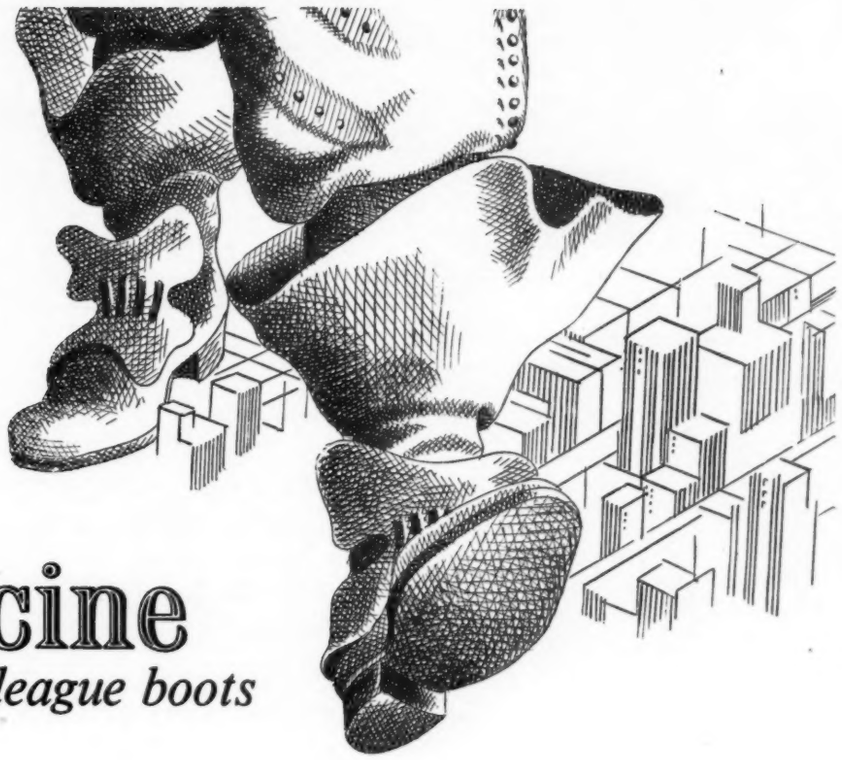

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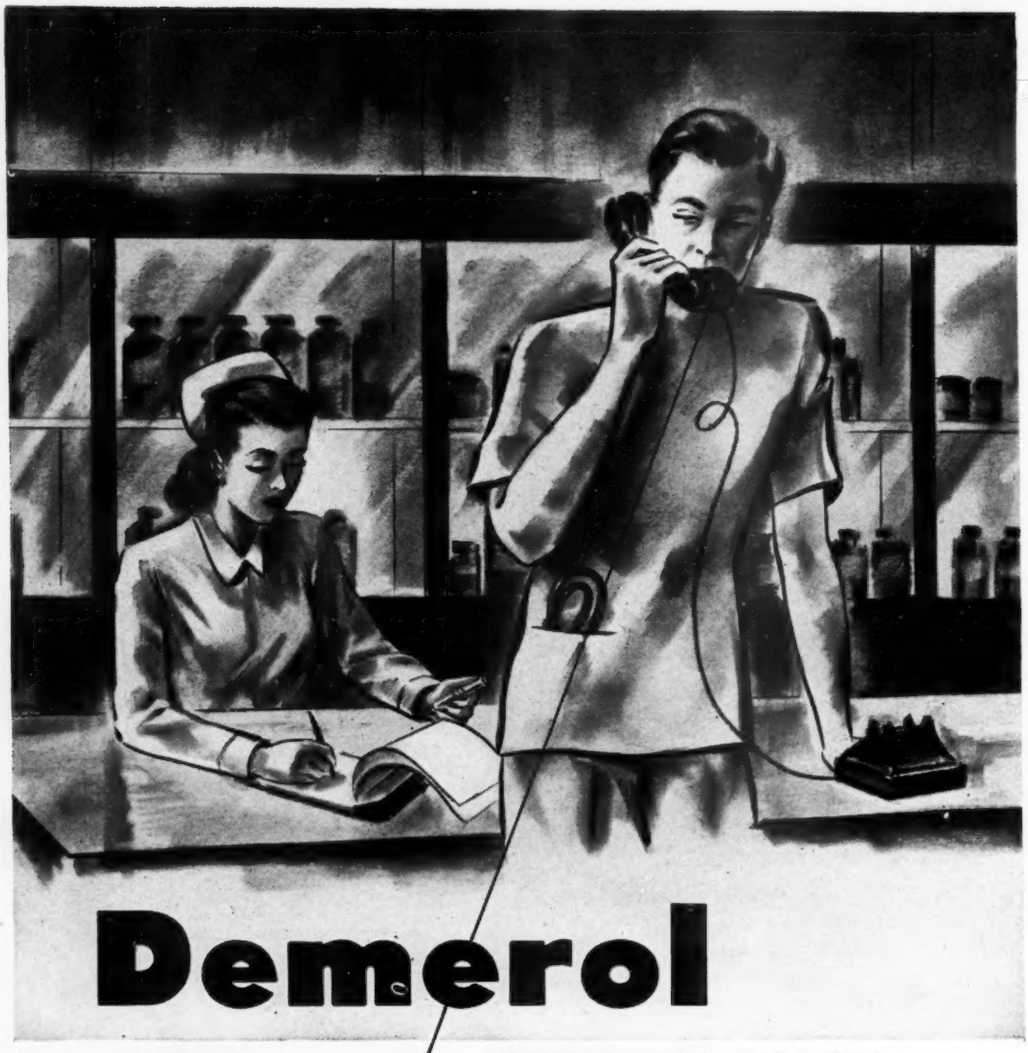

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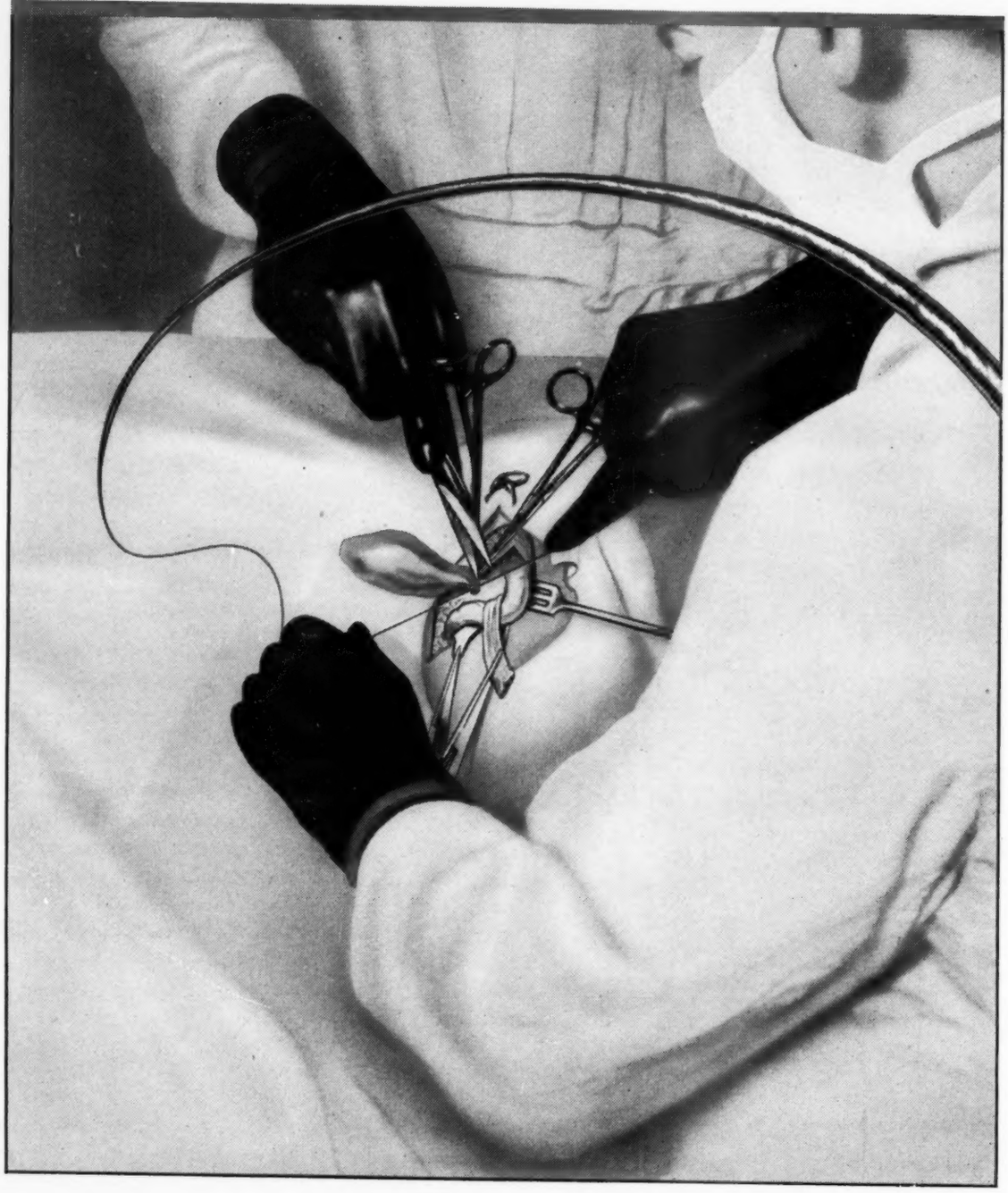

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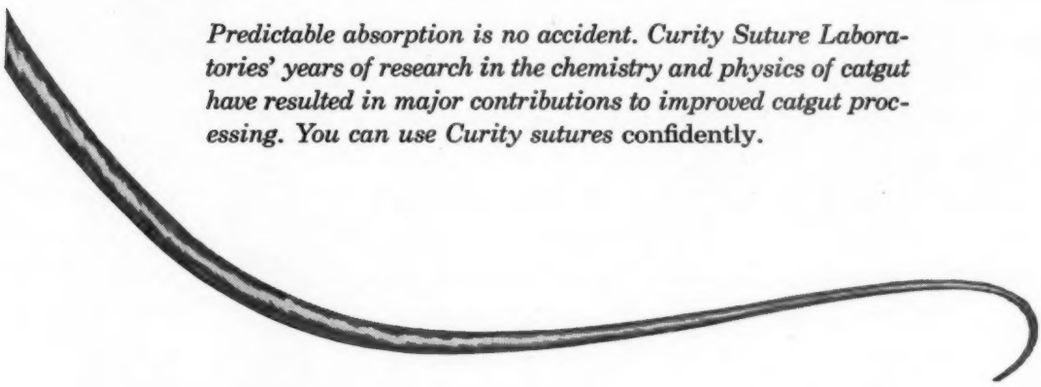

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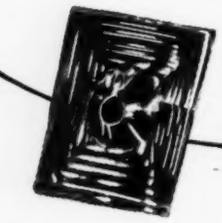

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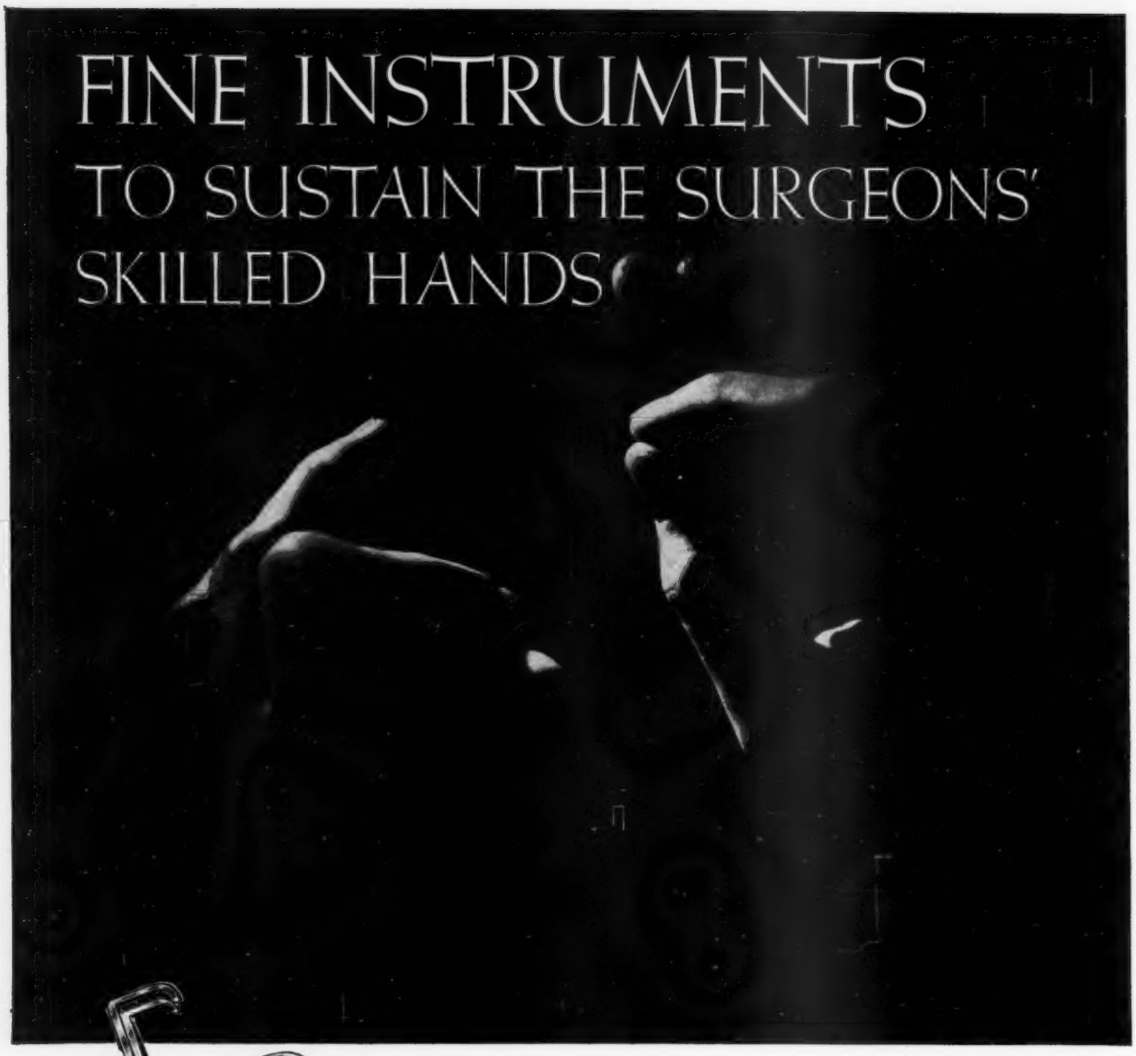

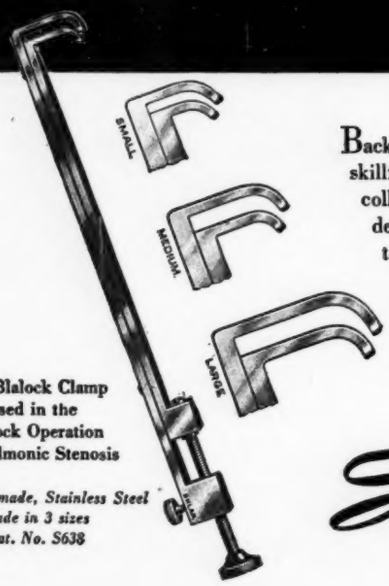

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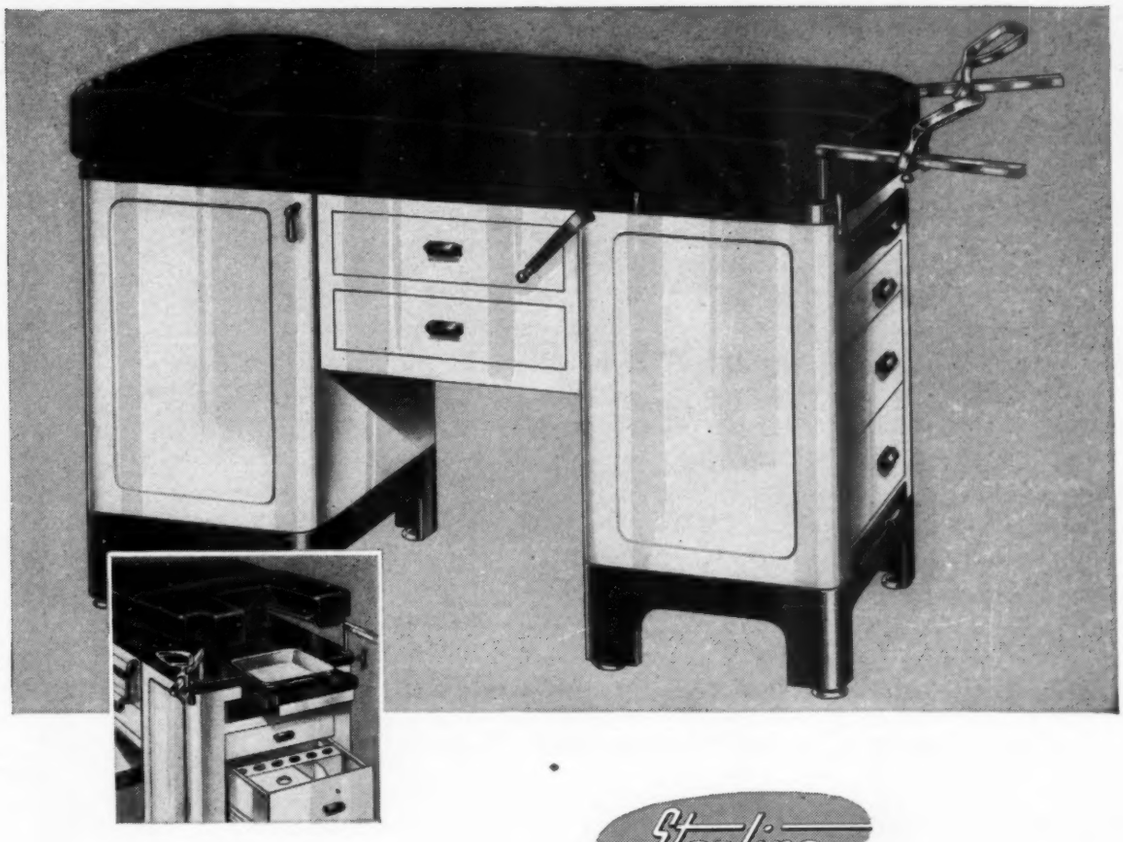

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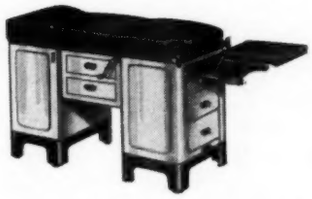

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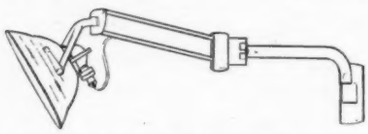

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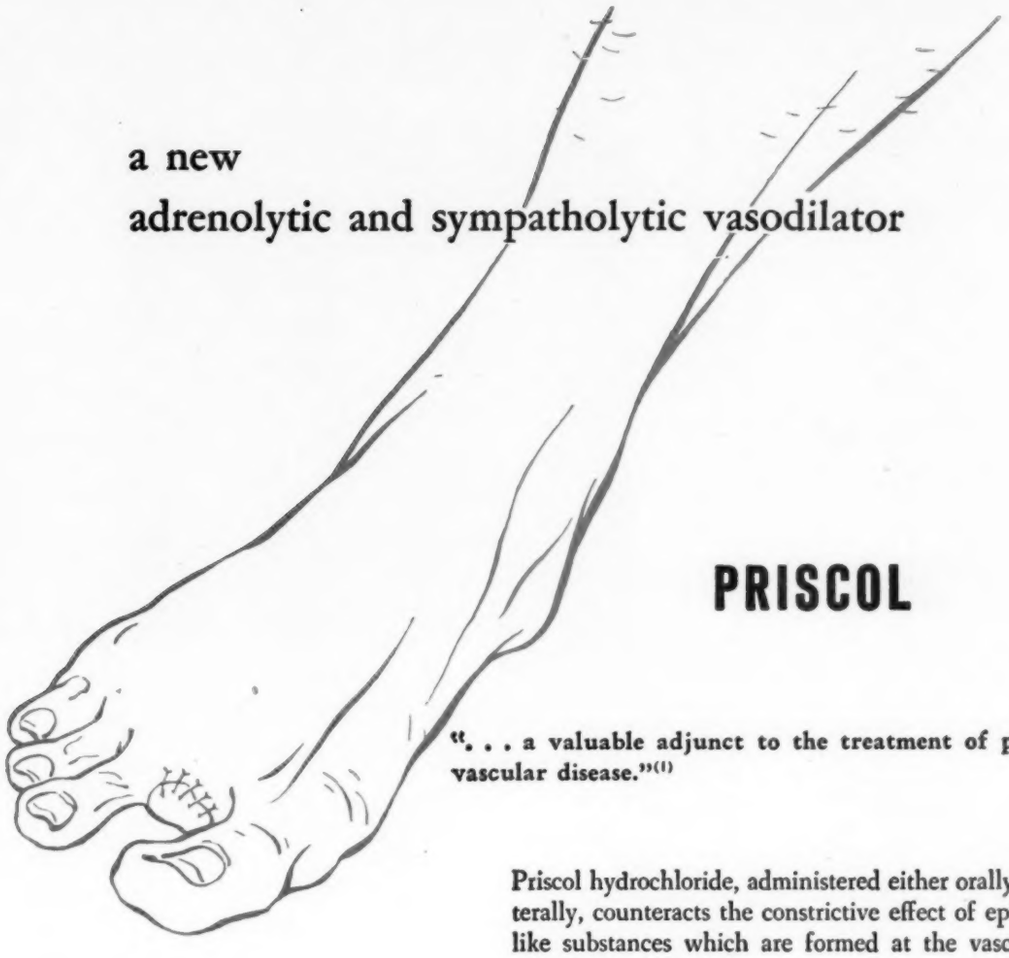

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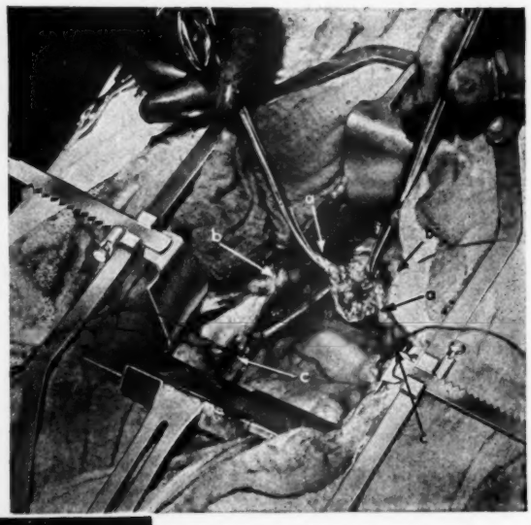
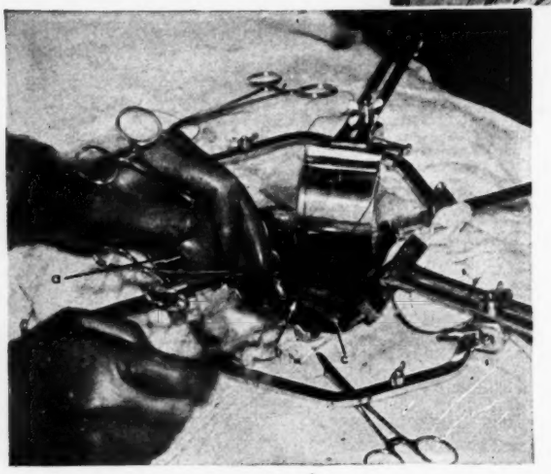


Above, Wexler Retractor in hysterectomy showing ease of exposure, a, uterine vessels; b, round ligaments; c, ovarian vessels.



At left, Wexler Retractor in cholecystectomy showing cleanly walled-off field of operation. Note clearly defined anatomical landmarks; a, gallbladder; b, ligature on cystic duct; c, common duct.

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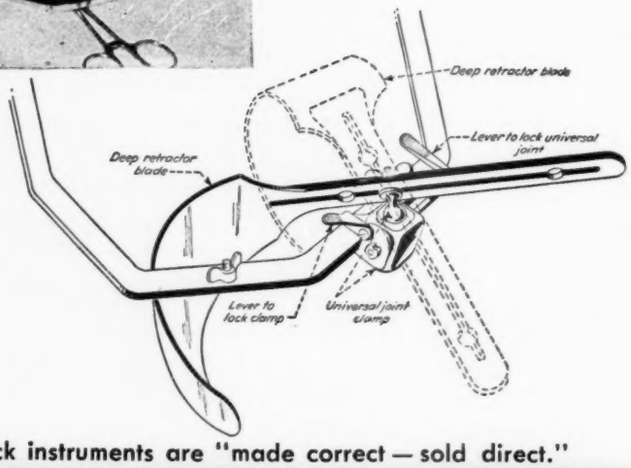

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#21022 Wexler Octagonal Frame with 2 sliding blades $52.00 each.
#21024 Wexler Universal Joint $40.00 each.
#R21026 Wexler Flexible Copper Plated Blade, $9 each.
#R21028 Wexler Deaver Type Blade, $9 each.
#21030 Wexler Expandable Blade, $30.00 each.

Remember Weck instruments are "made correct—sold direct."

Edward Weck & Co., Inc.

Founded 1890

Manufacturers Surgical Instruments

SURGICAL INSTRUMENT REPAIRING • HOSPITAL SUPPLIES

135 Johnson Street — Brooklyn, N. Y.

FROM THE PAINTING BY MARIE D. PAGE

COURTESY, AMERICAN COLLEGE OF SURGEONS

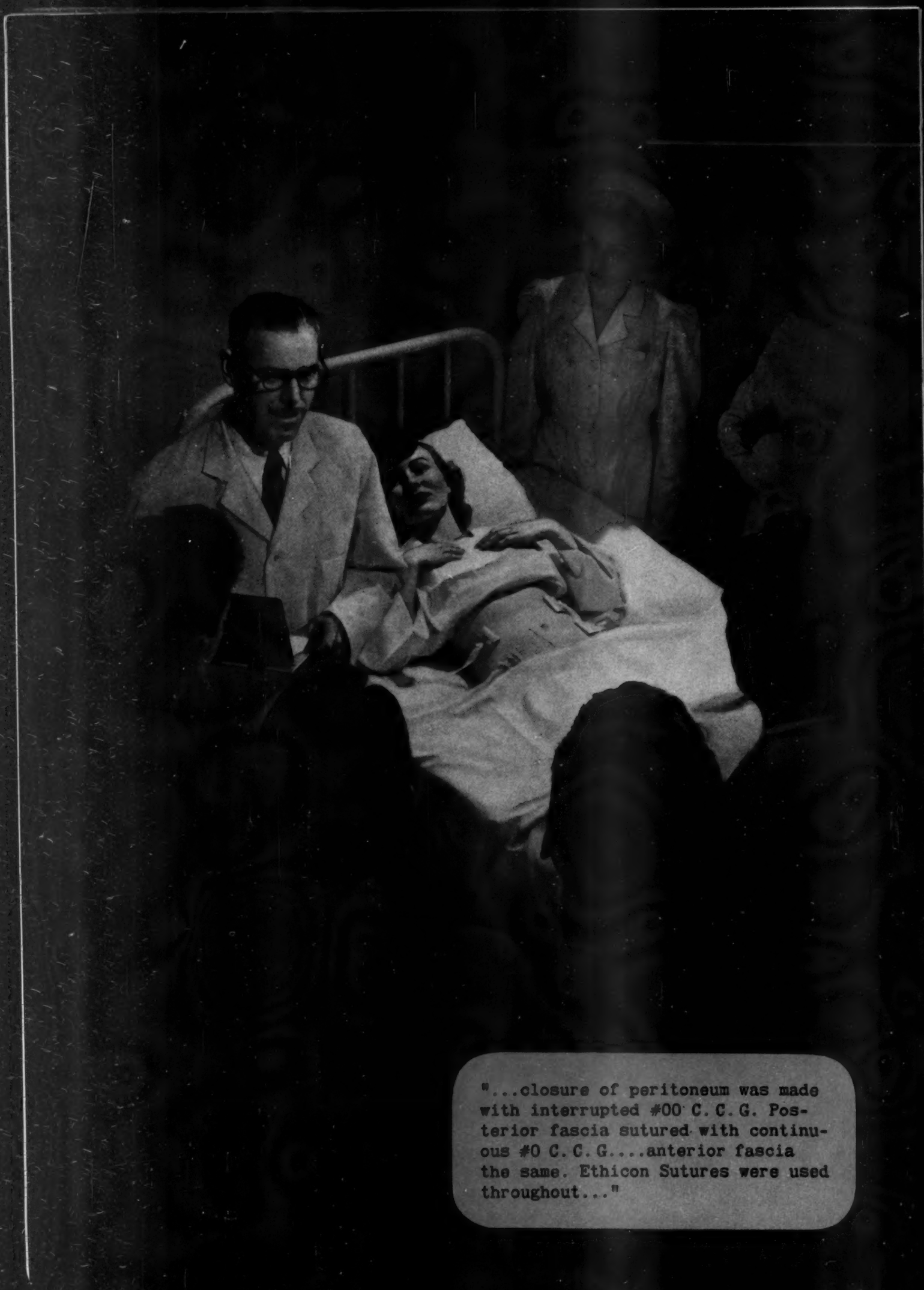
Fred Bates Lund

Fred Bates Lund is widely known and respected for his distinguished career among contemporary heirs to the mantle of Hippocrates. A surgeon and teacher of renown, Dr. Lund was born in 1865, and is now in his eighty-third year. He is one of the Founders, and a Life Member of the American College of Surgeons, which he served as Governor from 1915 to 1927.

Dr. Lund served for many years on the faculty of Harvard Medical School and as surgeon-in-chief of Boston City Hospital. He served terms as president of the Clinical Congress of Surgeons of North America and the American Surgical Association.

From the Series, Great American Surgeons, Published by

ETHICON SUTURE LABORATORIES, DIVISION OF JOHNSON & JOHNSON, NEW BRUNSWICK, N. J.


"...closure of peritoneum was made with interrupted #00 C. C. G. Posterior fascia sutured with continuous #0 C. C. G....anterior fascia the same. Ethicon Sutures were used throughout..."

USED THROUGHOUT

For your most meticulous work, the suture nurse will prepare Ethicon's new Bonded Catgut. This new strand is the result of postwar research in our laboratories. Its built-in tensile strength is 30% greater than in sutures previously produced.

Throughout the length of the strand you have the advantage of this 30% greater strength.

Throughout the entire strand you are assured uniformity of diameter through Ethicon's exclusive Tru-Gauging Process.

Throughout the full diameter you get thorough, even chrome deposition and controlled digestion, the result of Ethicon's exclusive Tru-Chromicizing Process.

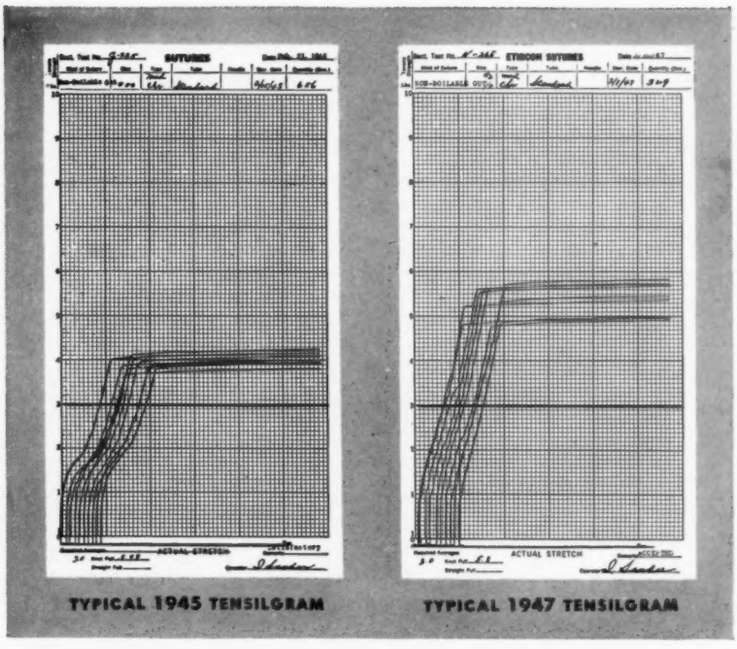
Throughout the strand you get uniform pliability, contributing to easy pull through tissue and trouble-free tying of single or double knots.

You now get 30% greater strength— proved by Ethicon's daily tests

Here's the mechanically-recorded laboratory proof of Increased Tensile Strength in Ethicon's New Bonded Catgut.

These tensilgrams are actual daily strength tests given each lot of sutures. Horizontal red lines at numeral 3 mark U.S.P. requirements for Knot-Pull Strength on Size 00, Non-Boilable Catgut.

Red curves show breaking points. Up to 30% greater strength and uniformity of strength are strikingly demonstrated. Note close grouping of breaking points, which indicates uniformity of product from strand to strand.

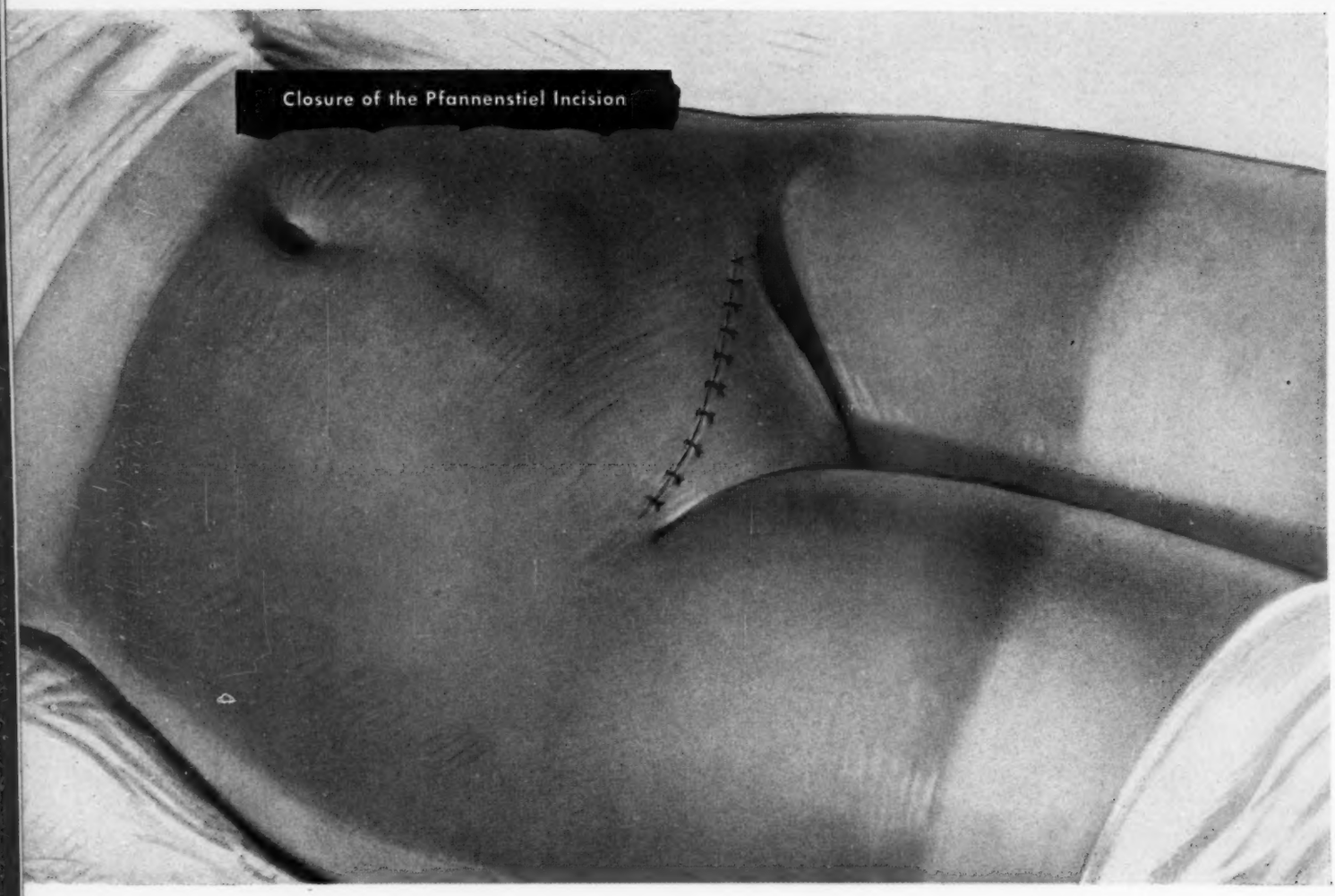


TYPICAL 1945 TENSILGRAM

TYPICAL 1947 TENSILGRAM

ETHICON Sutures

SUPERIOR IN THOSE QUALITIES IMPORTANT TO THE SURGEON



ETHICON SILK AND COTTON SUTURES

SILK—Prepared especially for the meticulous demands of the silk technic. You get more intrinsic strength, and minimal tissue reaction with Ethicon's Tru-Formed Black Braided Silk Sutures.

Ethicon Silk forms smooth, firm knots. It has minimal adherence to tissue.

Ethicon Silk is non-capillary, serum-proof, non-toxic, and strictly U.S.P. gauge.

Ask your O.R. Supervisor for Ethicon Silk.

COTTON—Ethicon Cotton, U.S.P., is the culmination of exhaustive laboratory and clinical study. It is specially prepared from imported 100% Egyptian long staple fiber. No talcum powder, harsh fillers, or harmful dyes are used. It is free from lint and irregularities.

Tensile strength is 10% to 30% greater than ordinary cotton. *Sizes are U.S.P.:* 4-0, 3-0, 2-0, 0. If you are a cotton man, try Ethicon Twisted Cotton.

ETHICON
Sutures

ETHICON SUTURE LABORATORIES

Division of Johnson & Johnson, New Brunswick, N. J.

World's Largest Manufacturer of Surgical Gut

Suture Laboratories at New Brunswick, N. J.; Chicago, Ill.; Brazil; Argentina; England; Australia

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For The Urologist—
The Utmost In Electrosurgical Utility!

WAPPLER
SURGICAL UNIT
C-263

Designed primarily to meet the exacting requirements of urologic electro-surgery, this WAPPLER SURGICAL UNIT combines great power with precise and **blended** control (when required) of cutting and coagulating currents in any proportion desired. For transurethral resections, and other urologic procedures, this high frequency unit cuts and coagulates with such ease and speed as to expedite materially the most difficult techniques. When the employment of tissue cutting and haemostatic currents is indicated in other fields, such as General, Thoracic, Proctologic, Ophthalmologic Surgery, etc., the remarkable simplicity of control, complete dependability and uniformly excellent results achieved with the WAPPLER C-263 recommend it as the instrument of choice.

Splashproof Footswitch permits ready current selection and control by operator, once rheostats are set.

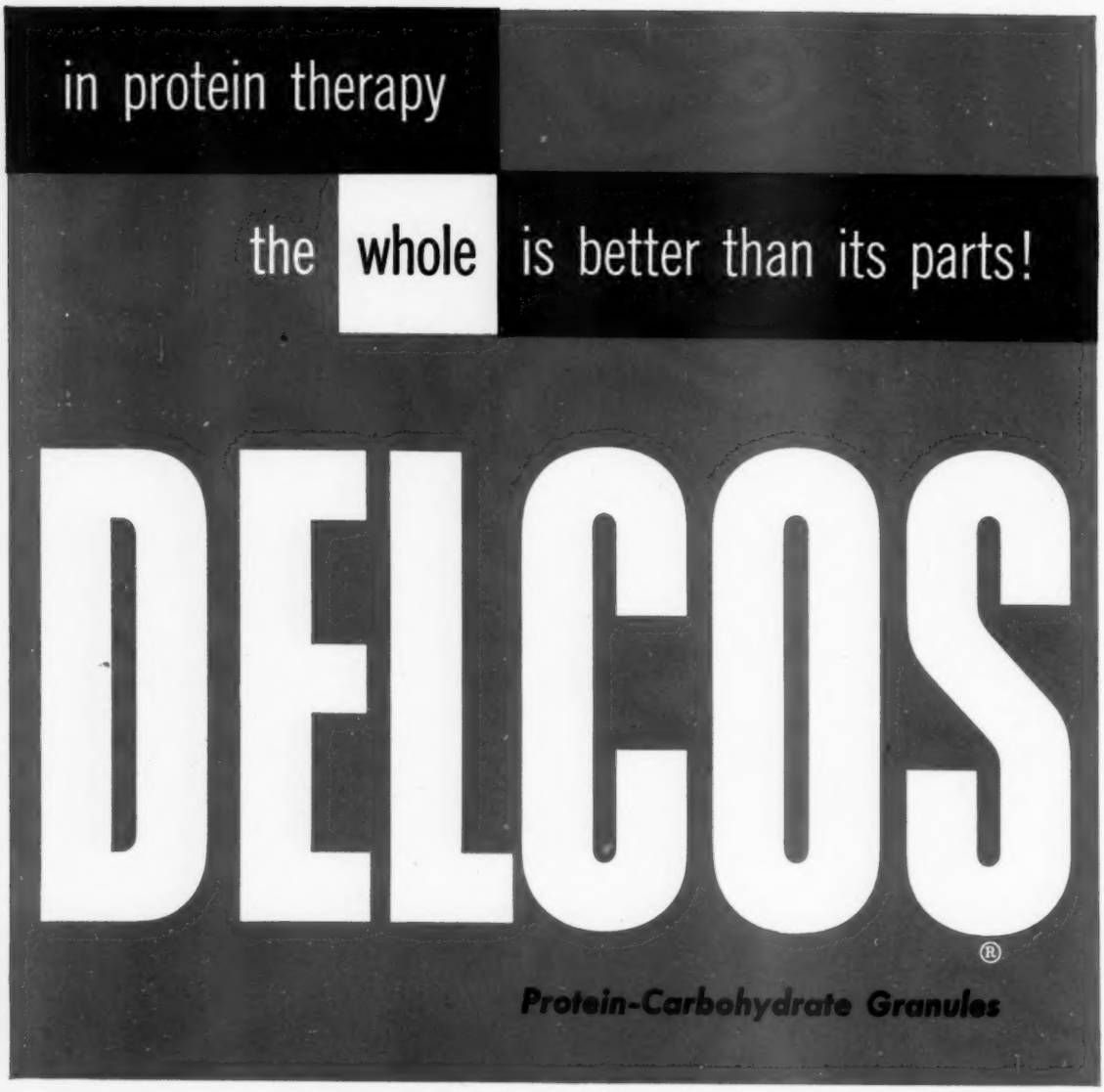
See Your Dealer—
Write for Literature

A·C·M·I· TRADE MARK

AMERICAN CYSTOSCOPE MAKERS, INC.

FREDERICK J. WALLACE, President

1241 LAFAYETTE AVE. NEW YORK 59, N. Y.



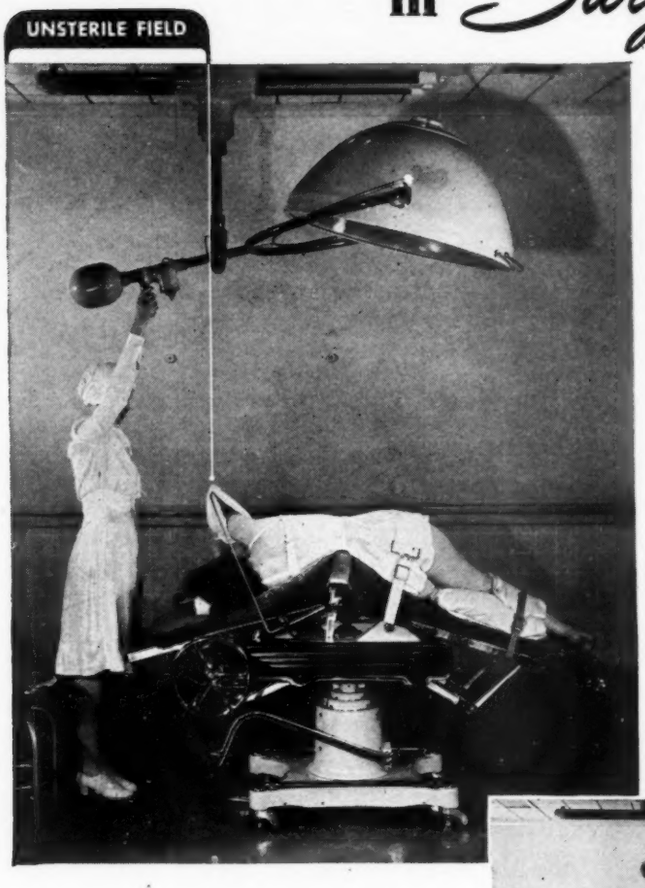
Protein therapy is of fundamental importance in every branch of medicine. For the vast majority of patients, the safest and most practical route of administration is by mouth. And the problem of acceptance is readily overcome by the use of DELCOS granules.

Patients like Delcos granules because they are not only palatable, but actually delicious! The reason is simple: DELCOS provides *whole* proteins (casein and lactalbumin), rather than digested proteins or pure amino acids, which are characteristically unpleasant and often induce nausea, vomiting, or diarrhea.

Whole protein is easy to take in large doses, over long periods of time, and is efficiently utilized. Moreover, the whole protein in DELCOS granules provides all vital elements intact, concentrated, and in proper balance for high metabolic effectiveness.

When oral protein is indicated, prescribe DELCOS granules, the protein that patients accept, dose after dose, day after day. Supplied in 1-lb. and 5-lb. jars. Write today for tasting samples, literature, and a booklet of DELCOS recipes. Professional Service Department, Sharp & Dohme, Philadelphia 1, Pa.

A New Standard of Performance in *Surgical Lighting*



The "AMERICAN" postwar *Luminaire*

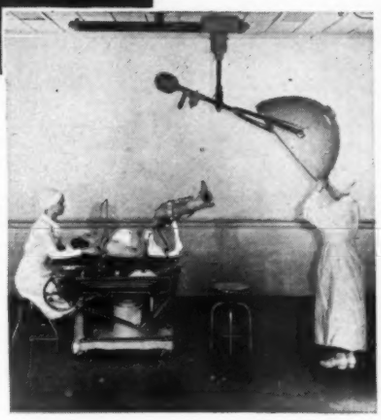
(MODEL DMCA)

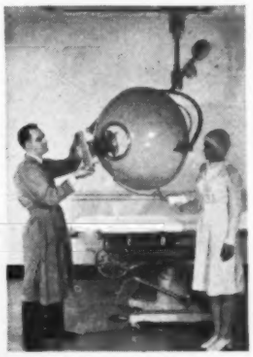
Complete intensity and directional control can be readily maintained by the circulating nurse or anesthetist from the Head End of the operating table . . . *outside the sterile surgical area.* This excellent point of vantage insures accuracy as well as speed in making the changes in position called for by the surgeon before or during the operation. All interference with the surgical team is avoided.

NOTE DUAL CONTROL FEATURE which permits full manipulative direction of true horizontal light-beam approaches . . . an exclusive advantage made possible by a unique combination track and offset mounting. Height adjustment over the operative site, and complete flexibility of illumination from any desired angle in both vertical and horizontal planes can now be quickly and accurately attained.

Only "American" Luminaires provide these additional combined advantages–

- ***Choice of light intensities before and during operation.***
- ***Unsurpassed shadow reduction.***
- ***Diagnostic color control.***
- ***Scientific heat control.***





Note convenience and simplicity of cleaning and maintenance operation

WRITE TODAY *for descriptive literature*

AMERICAN STERILIZER COMPANY

Erie, Pennsylvania

DESIGNERS AND MANUFACTURERS OF SURGICAL STERILIZERS, TABLES AND LIGHTS

Liver Integrity and the Protein Intake

That the prognostic outlook in fatty infiltration of the liver and in portal cirrhosis is no longer poor is a reflection of the significant advances made in the treatment of these conditions. Modern-day therapy is based on the recognition of the role played by lipotropic agents, such as choline, when given in conjunction with a diet high in biologically complete protein and low in fat.

While formerly carbohydrate was considered the chief factor in the maintenance of hepatic function, protein is now regarded one of the most important dietary principles in safeguarding the integrity of the liver. Unless given with adequate amounts of protein, carbohydrate alone is ineffective. For this reason, the modern dietary of many hepatic affections provides protein in abundance in addition to carbohydrate.

Lean meat enjoys an outstanding position in the protein-rich dietary for many reasons: It provides a generous proportion of biologically complete protein—25 to 30 per cent of its cooked weight. Meat is of remarkably high digestibility—from 96 to 98 per cent—imposing no added burden on the patient.

Meat also is an excellent source of three vitamins of the B complex: thiamine, riboflavin, and niacin, and in addition provides notable amounts of the important minerals phosphorus and iron. The taste appeal of meat is high, an advantage in diseases accompanied by lack of appetite.

The Seal of Acceptance denotes that the nutritional statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

American Meat Institute

Main Office, Chicago... Members Throughout the United States

ULTRACAIN *therapy*

Wherever an anesthetic, bacteriostatic and fungistatic ointment is indicated —

ULTRACAIN® OINTMENT offers prompt and prolonged relief in pruritus, ulcers, fissures, lacerations, abrasions, burns and in mucocutaneous lesions.

It is significantly free from allergizing side-effects.

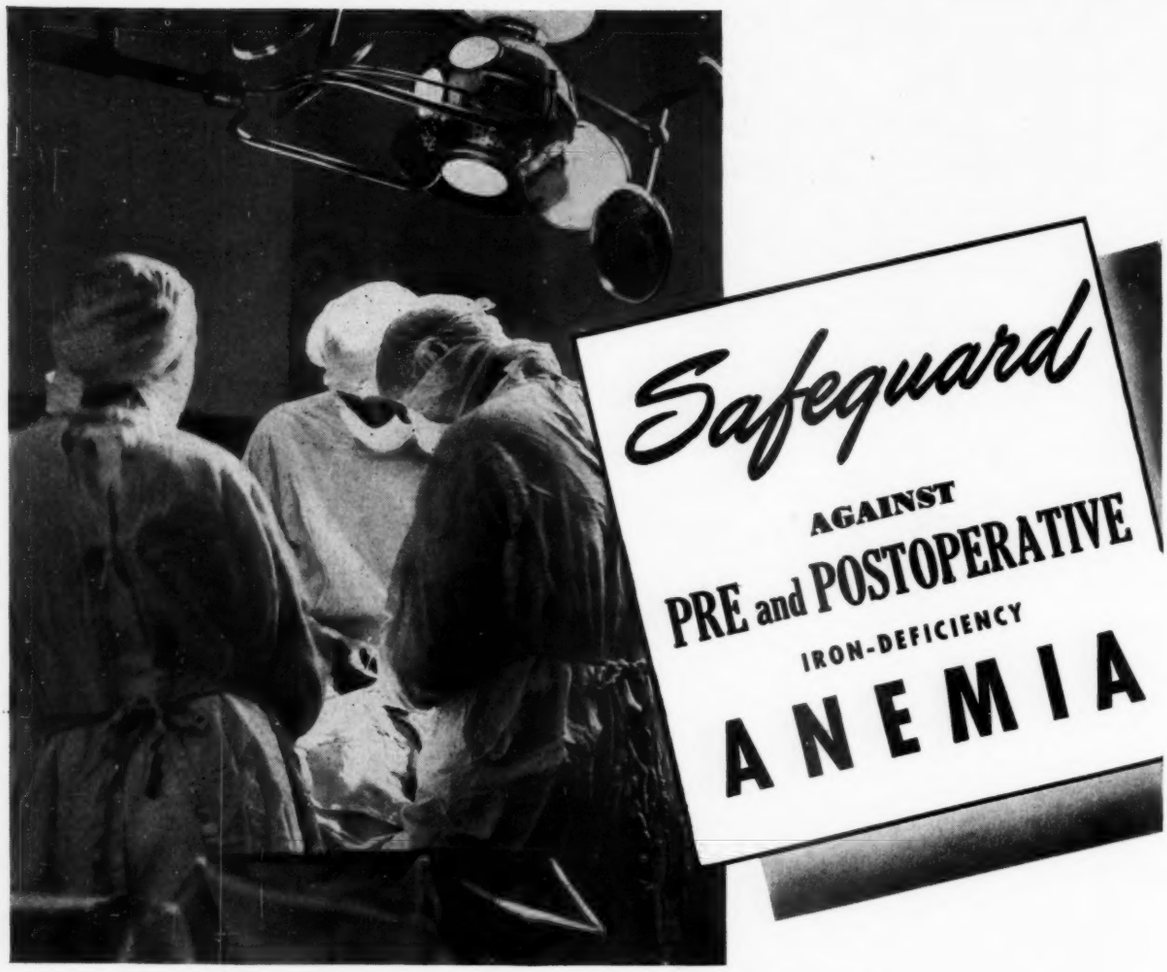
Write for literature.

Chatham

CHATHAM PHARMACEUTICALS, INC.

NEWARK 2, NEW JERSEY

Distributed in Canada by FISHER & BURPE, LTD., Winnipeg, Manitoba



Iron-deficiency anemia is a factor to be considered in pre and postoperative conditions. Hence, we suggest that you prescribe Copperin routinely for a period preceding and following surgery. Copperin stimulates the hematopoietic system—provides material for replacement of hemoglobin—increases the red blood cell count.

Because in Copperin iron ammonium citrate is combined with the catalyst copper sulphate, there is a greater utilization of the iron by the system. For this reason the iron content per capsule is purposely small—32 Mgm. As there is no stomach irritation or constipating effect from Copperin, it is exceptionally well adapted to routine use. In two strengths: Copperin "A" for adults; Copperin "B" for children.

Liberal professional samples gladly sent on request

MYRON L. WALKER COMPANY, Inc.
Mount Vernon **New York**

ACR-ALLANTOMIDE

OINTMENT

The newest

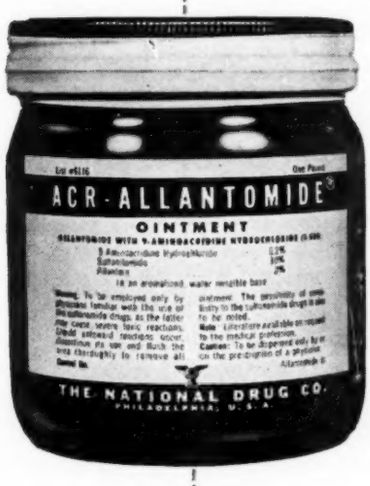
in the chemotherapy of wounds

The antiseptic properties of the acridines have been known for some time and 9-aminoacridine is one of the most useful.

In Acr-Allantomide Ointment 9-aminoacridine is combined with sulfanilamide. Thus, full use is made of the natural synergism that exists when these two potent antibacterial agents are combined.[1,2]

Acr-Allantomide Ointment offers these important advantages:

1. It is effective against an extremely wide bacterial spectrum.
2. It is effective in the presence of pus.
3. It is non-injurious.
4. It does not sting.



Acr-Allantomide Ointment is intended for use in the local treatment of wounds, topical ulcers, burns and related surgical conditions. It is also of value in dressing boils, carbuncles and infected lesions.

[1] Martin, G. J. & Moss, J.: Proc. 111th Meeting A. S. C., p. 2B. Atlantic City, N. J. (April 14-18) 1947.

[2] Spotts, S. D.: Am. J. Surg. 2:183 (Aug.) 1947.

ACR-ALLANTOMIDE OINTMENT IS AVAILABLE IN 1 OUNCE TUBES AND 1 POUND JARS. DESCRIPTIVE LITERATURE AND SAMPLES WILL BE SENT ON REQUEST.

THE NATIONAL DRUG COMPANY PHILADELPHIA 44, PENNA.

PHARMACEUTICALS • BIOLOGICALS • BIOCHEMICALS FOR THE MEDICAL PROFESSION

NATIONAL DRUG COMPANY

Outside the Ivory Tower

IF an atom bomb should fall on an American city, the population would be faced with the greatest emergency in its history. But it is by no means true that the entire population would be wiped out, nor is it true that nothing could be done to help the survivors, according to Army Medical Corps officers who are conducting continuous study of the problem. There is no presently known method of protecting those in the immediate neighborhood of an atomic bomb when it explodes. Nevertheless, since the Los Alamos experiment opened the Atomic Age, a great deal has been learned about mitigating the secondary effects of ionizing radiation and about protecting survivors who have received less than a lethal dose. Many lives may be saved by widespread knowledge of therapeutic measures among physicians, and many more by a general understanding of preventive measures which can be taken by the general population. The real difference between ordinary high explosives and atom bombs is the enormous amount of radiant energy produced by the latter,—energy covering the whole range of wave lengths from heat waves to million-volt gamma waves.

The radiant energy may be divided into two types, ionizing and non-ionizing. The most important type of injury noted in Hiroshima and Nagasaki was, of course, that due to the ionizing component of the radiant energy from the bomb. Four known kinds of penetrating radiation can be expected within the immediate area of the blast. A major function of the physician after such a disaster would be to act as public health officer. Most food in the affected area would not be unfit for consumption but it would all have to be surveyed before it could safely be eaten. All the water in the region would probably contain radio-active isotopes, slow poison to anyone drinking it, but research is in progress on methods of removing radio-active substances. Obviously the usual boiling or chlorination would be useless. There is some indication that filtration and other methods can be developed. Physicians would have a heavy responsibility in supervising the decontamination of not only food and water but of refugees, by means of complete change of clothing, bathing, etc. This requires familiarity with the use of detecting instruments, such as the Geiger counter, and a knowledge of the kinds of persistent radiation to be expected. (People escaping from the area where a bomb has exploded may find their wearing apparel sufficiently radio-active to constitute a menace to others.) This problem has already come up in hospitals where patients are being treated with large amounts of radio-active material.

THE divorce rate in the United States, which has been climbing for many years, accelerated its rise in the immediate postwar period and reached an all-time high in 1946. Further examination of the figures shows that the recent upswing in the divorce rate was sharpest among those married less than five years—that is, essentially among those married during the war. A smaller, but still appreciable rise occurred also among families of longer standing.

The probability of divorce among couples married only a relatively short time has more than doubled since Pearl Harbor. Whereas little more than 7 per cent of marriages ended in divorce within five years in 1941, the proportion reached nearly 17 per cent in 1946. Under current conditions a greater proportion of marriages are dissolved by divorce within five years than had been dissolved within the first 14 years of married life in any year of our history prior to 1941. The unstable character of many wartime marriages may be attributed to a variety of factors, among them hasty marriage, long separation during the war, and the general difficulty of readjustment to postwar life.

(From the Statistical Bulletin Metropolitan Life Ins. Co.)

(continued on page 42)

Companion to hemostat and suture

OXYCEL®

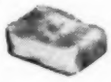
Absorbable Hemostatic Oxidized Cellulose in gauze-type and cotton-type forms.

In the operating room and the office

Where oozing persists despite ligation of all discernible blood vessels, OXYCEL applied as a surgical pack controls bleeding promptly. As vital as the surgeon's hemostat, OXYCEL minimizes trauma and shortens operative procedure.

Minor surgical procedures may be carried out with greater confidence and with less risk of psychic trauma to the patient. Use of OXYCEL controls bleeding that persists following placement of ligature and suture.

OXYCEL, Parke-Davis oxidized cellulose, is available in convenient forms of application to bleeding surfaces in body cavities and tissues. In surgical wounds in soft tissues, it is absorbed without producing irritation or delaying healing.

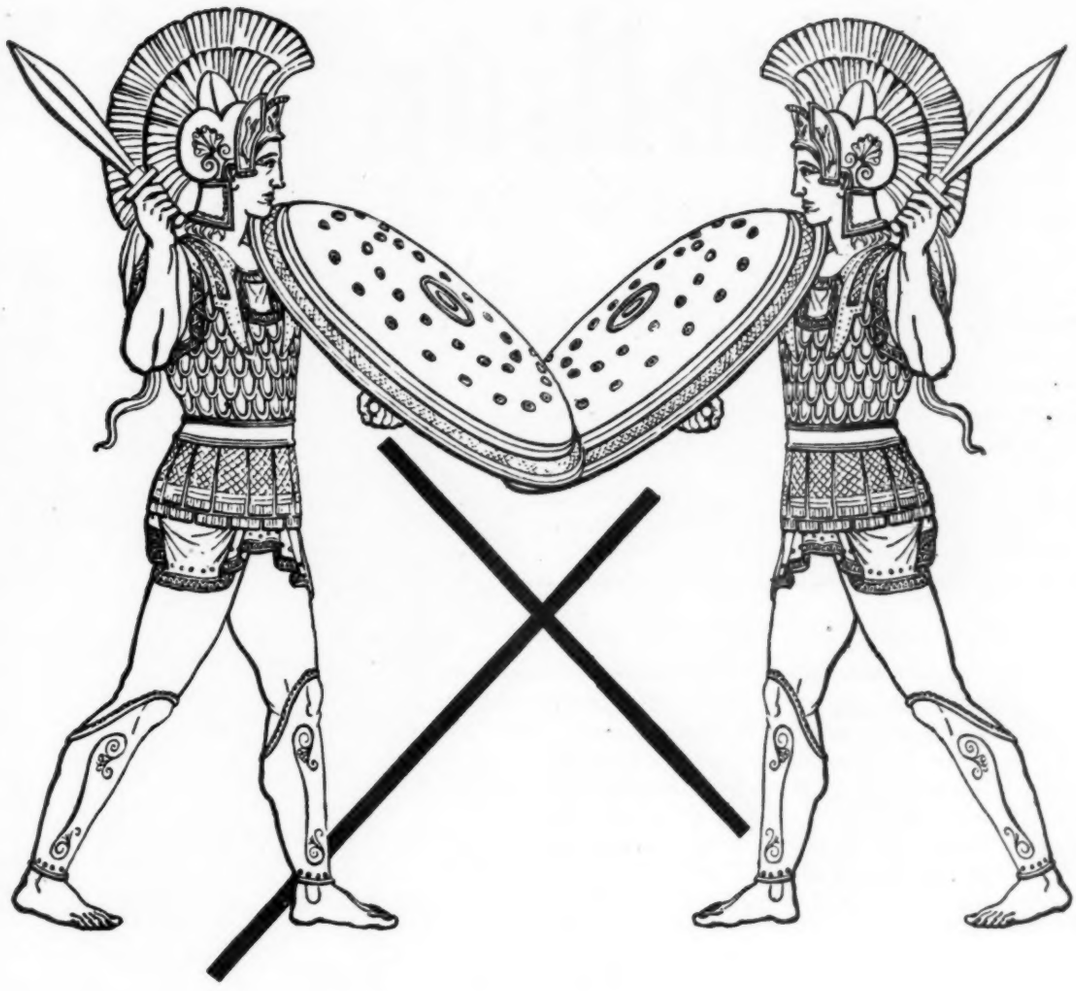
STRIPS PADS  PLEDGETS FOLEY CONES

PACKAGE INFORMATION: Supplied in individual glass containers in the following convenient forms:
OXYCEL PADS: Sterile, gauze-type 3 in. x 3 in. eight-ply pads.
OXYCEL PLEDGETS: Sterile, cotton-type 2¼ in. x 1 in. x 1 in. portions.
OXYCEL STRIPS: Sterile, four-ply, gauze-type strips 18 in. x 2 in., pleated in accordion fashion.
OXYCEL FOLEY CONES: Sterile, four-ply, gauze-type discs, 5 in. and 7 in. diameters, conveniently folded in radially fluted form.

PARKE, DAVIS & COMPANY · DETROIT 32, MICHIGAN

MEDICAMENTA VERA · PD CO.

Give..
Give
enough!
THROUGH YOUR
COMMUNITY CHEST



Thiamine therapy too often cuts two ways. Even as it rectifies thiamine deficiency, it can precipitate other B factor deficiency diseases.[1]

Solu-B* affords balanced, high potency, multiple (5) B vitamins to meet the most exacting needs of parenteral B vitamin therapy.

1. Editorial: J. A. M. A. 129:74 (Sept. 1) 1945

IN A SINGLE VIAL	SOLU-B	SOLU-B 5X
Thiamine Hydrochloride	10 mg.	50 mg.
Riboflavin	10 mg.	50 mg.
Pyridoxine Hydrochloride	5 mg.	25 mg.
Calcium Pantothenate	50 mg.	250 mg.
Nicotinamide	250 mg.	1250 mg.

THE PACKAGE:

Solu-B with Distilled Water. In boxes of five vials Solu-B with five 5 cc. ampoules of Sterile Water for Injection.

Solu-B (Plain). In boxes of twenty-five vials.

Solu-B 5X. Each vial is accompanied by one 30 cc. vial of Sterile Water for Injection.

Solu-B with Ascorbic Acid. In boxes of five vials Solu-B with five 5 cc. ampoules Ascorbic Acid 500 mg.

Solu-B

Upjohn
KALAMAZOO 99 MICHIGAN

fine pharmaceuticals since 1886

** Trademark, Reg. U. S. Pat. Off.*

can Vitallium *appliances be* BENT?

Vitallium bone plates can be bent with bending irons to the extent required for adaptation to bone contours. The surgeon can have full confidence that Vitallium bone plates, which are tough and strong, will meet the normal demands of operative procedures . . . The design and functional strength of VITALLIUM SURGICAL APPLIANCES have steadily improved over the years.

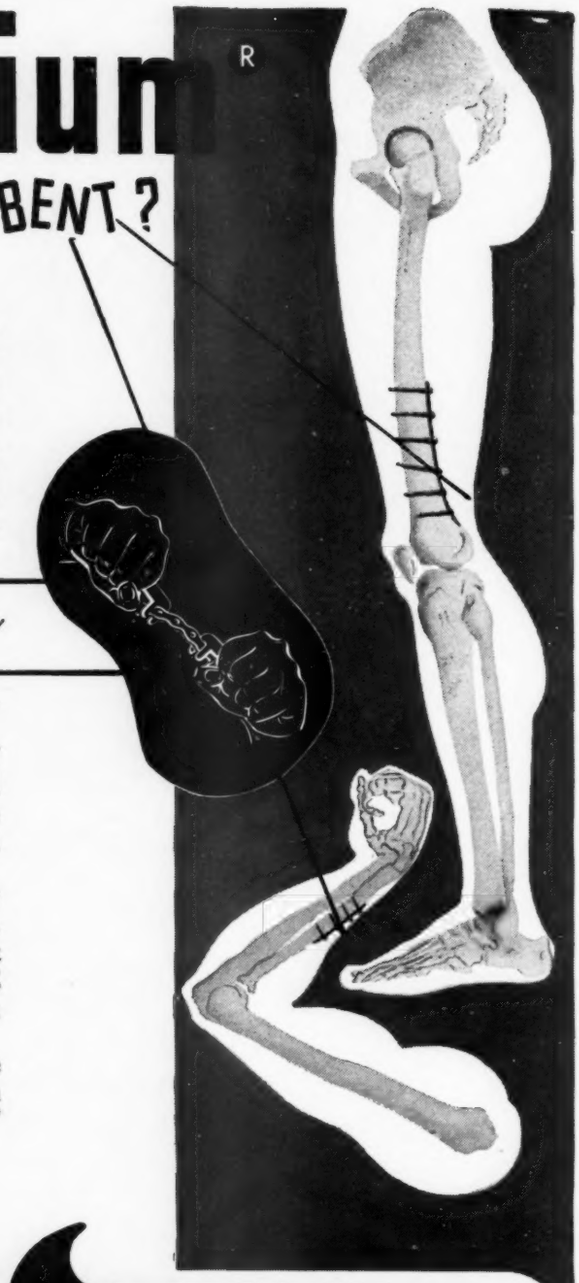
with bending irons

By means of continuing research in metallurgy, design engineering, in Microcast® Production Processes and because of X-ray inspection, Vitallium bone plates and other VITALLIUM APPLIANCES today are greatly improved in strength and function over those produced several years ago.

The superior alloy used in VITALLIUM APPLIANCES has undergone no major change. The formula is stable and standardized. It it still THE one inert surgical metal, THE cobalt-chromium alloy developed for use in the body.

VITALLIUM APPLIANCES are made by the Austenal-devised Microcast Process and can be identified by their characteristic "satin" finish.

ORDER THROUGH YOUR SURGICAL DEALER



VITALLIUM APPLIANCES — STRONG · NEUTRAL · PASSIVE IN VIVO
Completely tolerated by bone and tissue

some other Vitallium appliances—
Hip Nails • Spinal Fusion Plates • Fracture Nails • Bile Duct Tubes • Blood Vessel Tubes • Skull Plates

ORDER THROUGH YOUR SURGICAL DEALER!

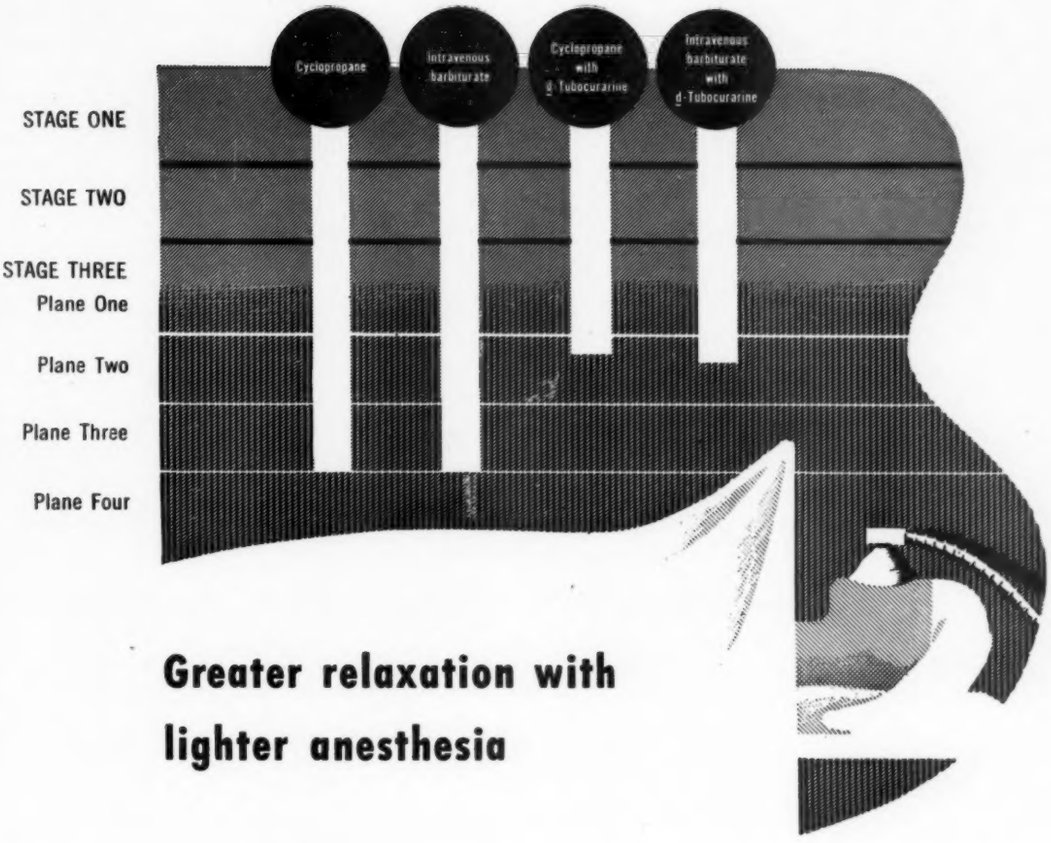
CATALOG AND LITERATURE AVAILABLE ON REQUEST

MICROCAST · VITALLIUM · TECHNIQUE

Austenal Laboratories, Inc.

NEW YORK — CHICAGO

SURGICAL DIVISION, 224 EAST 39TH STREET, NEW YORK 16, N. Y.



Greater relaxation with lighter anesthesia

d-TUBOCURARINE

with any of the general anesthetic agents, provides excellent muscular relaxation and *decreases the need* for deep anesthesia—thus lessening the anesthetic hazards in surgery, especially in "poor risk" patients.

d-TUBOCURARINE

- reduces amount of anesthetic required
- shortens the period of recovery
- minimizes postanesthetic complications
- in proper dosage causes no appreciable change in blood pressure, cardiac rate, or body economy

d-Tubocurarine should be administered by trained anesthetists and with facilities for respiratory control at hand.

d-TUBOCURARINE CHLORIDE SOLUTION

Standardized by weight to contain 3 mg. d-Tubocurarine chloride pentahydrate per cc., equivalent to 20 units of Intocostrin.

SQUIBB

Breakfast Adequacy and Somatic and Psychic Stability

The three-meal schedule of daily eating, with a heritage of intuitive origin, now is acknowledged vital to an adequate smoothly flowing nutrient stream for providing the metabolic needs throughout the day. Of corollary importance, is the growing conviction that the morning breakfast should provide ¼ to ⅓ of the day's burden of food intake. Good somatic and psychic functioning during the forenoon hours are thereby nutritionally insured. Hyponutritional manifestations of untimely hunger, fatigue and irritability are minimized.

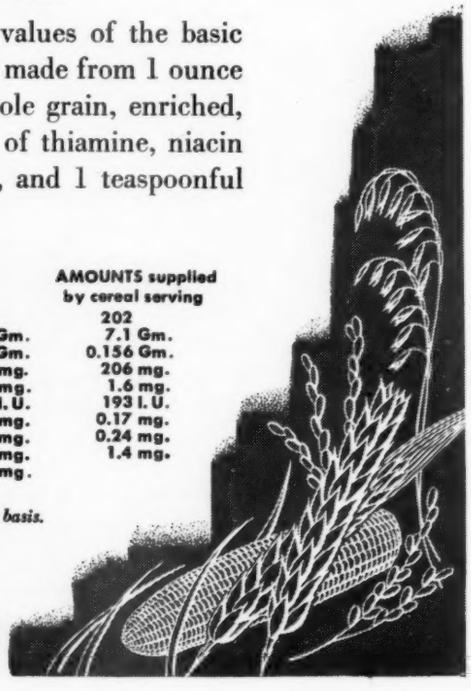
A simple application of these nutrition principles is a widely accepted basic breakfast pattern consisting of fruit or fruit juice, cereal (hot or ready to eat), milk, bread and butter. The serving of cereal with milk and sugar is an important and appetizing feature of this basic breakfast pattern. It provides biologically complete proteins, carbohydrates for caloric energy, important minerals and vitamins—all in excellent proportion. Should the portions usually consumed provide less than ¼ or ⅓ of the day's total nutriment requirements, then they can be augmented with eggs, breakfast meats or other suitable foods.

The table depicts the nutrient values of the basic breakfast and of the cereal serving made from 1 ounce of ready-to-eat or hot cereal* (whole grain, enriched, or restored to whole grain values of thiamine, niacin and iron), 4 fluid ounces of milk, and 1 teaspoonful of sugar.

The presence of this seal indicates that all nutritional statements in this advertisement have been found acceptable by the Council on Foods and Nutrition of the American Medical Association.

BASIC BREAKFAST	TOTALS supplied by Basic Breakfast	AMOUNTS supplied by cereal serving
Orange juice, 4 oz.; Ready-to-eat or Hot Cereal, 1 oz.; Whole Milk, 4 oz.; Sugar, 1 teaspoon; Toast (enriched, white), 2 slices; Butter, 5 Gm. (about 1 teaspoon); Whole Milk, 8 oz.		
CALORIES	611	202
PROTEIN	20.7 Gm.	7.1 Gm.
CALCIUM	0.465 Gm.	0.156 Gm.
PHOSPHORUS	488 mg.	206 mg.
IRON	3 mg.	1.6 mg.
VITAMIN A	1074 I.U.	193 I.U.
THIAMINE	0.52 mg.	0.17 mg.
RIBOFLAVIN	0.87 mg.	0.24 mg.
NIACIN	2.3 mg.	1.4 mg.
ASCORBIC ACID	64.8 mg.	

**Composite average of all breakfast cereals on dry weight basis.*



CEREAL INSTITUTE, INC.

A research and educational endeavor devoted to the betterment of national nutrition.

135 South La Salle Street • Chicago 3

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Editorials

MODERN SURGICAL MANAGEMENT OF NEOPLASMS OF THE HEAD AND NECK

THIS editorial deals with tumors of the face, lips, oral cavity and accessory sinuses, and primary and metastatic tumors in the neck. It does not include tumors of the central nervous system which belong to a separate specialty.

Surgery of these diseases has improved continually but there is much left to be desired by way of treatment. Thirty years ago the advent of x-ray and radium therapy into the realm of neoplastic diseases gave the medical world high hopes for greatly increased percentages of cures of cancers of the head and neck. These hopes have been realized only partially. There are many malignant tumors which until recently have been totally inoperable because of location, *i.e.*, pharynx and tonsil, and others because of the extent to which they have grown before the patient sought medical advice. Fortunately some of these are palliated and a few survive the five-year period with adequate irradiation. Other cancers of the face, lips and anterior part of the tongue are frequently eradicated by radium or x-ray therapy with little mutilation.

However, radiology does fall short of the anticipated percentage of cure. Those tumors which are radioresistant but shrink greatly with irradiation are often removed surgically. Other cancers require so much therapeutic irradiation that immediate or late sequellae develop as radio-osteonecrosis, early or late, and sloughing of the scar in the mouth subsequent to secondary infection (sore throat or infected tooth). Surgical removal of the irradiated area or the necrotic bone, therefore, becomes imperative sooner or later. It is quite obvious then that in many cases irradiation and surgery are combined in order to eradicate the disease and to shorten the period of convalescence, or to hasten the repair of damage brought on by the necessarily heavy irradiation required to destroy the cancer. Fortunately in recent years there have been certain advances in surgical technic which have made it possible to perform extensive operations about the head and neck that twenty or thirty years ago were unheard of or, if tried, were associated with high surgical mortality. These improvements fall into six important classes:

Preoperative *irradiation* of malignancies about the oral cavity and accessory sinuses has the following advantages: (1) If the cancer is radiosensitive, it might be possible to eradicate it completely and avoid operation. (2) If moderately radiosensitive, the growth will be greatly reduced in size and its vitality diminished, making operative removal easier and safer. The cancer is

surrounded by dense scar tissue thus walling off the local growth and metastases in the neck so that the operation can be performed without encountering active viable tumor cells. It is true that preoperative irradiation increases the vascularity of the tissues and often obliterates fascial plains. Some authorities claim that this increases the difficulty of operation. However, such difficulties are far outweighed by the increased safety of operation and reduced size of the tumor. Also, the electrosurgical technic offsets the increased vascularity.

Anesthesia which about a hundred years ago greatly enlarged the fields of surgery has in recent years taken on new developments. The administration of inhalation anesthesia has always been difficult with patients undergoing operations about the head, particularly the face and mouth. The use of pentothal sodium intravenously has given the surgeon freedom from annoying anesthetic apparatus about the head. Intratracheal anesthesia also has increased the efficiency of modern anesthetics and has given the anesthetist an opportunity to control gases and air inhaled and exhaled. Intratracheal anesthesia also permits adequate packing of the nasopharynx and hypopharynx with gauze to prevent the aspiration of blood, particles of tissue, bone or teeth which would cause postoperative pneumonia, lung abscesses, etc., complications which formerly were common following oral operations.

One of the great dangers in surgery of the head and neck in former years was secondary infection, both local and through extension into the neck and lungs, as well as systemic infection. Modern *antibiotics* such as sulfa drugs and penicillin eliminate postoperative infection in the operative field, chest or blood stream almost completely.

Because of the vascularity of the tissues about the oral cavity the hemostatic properties of *electrosurgery* are now indispensable in hemiglossectomy or the safe removal of large neoplasms in the mouth and pharynx. The small operative space in the mouth does not allow the application of a large number of hemostats. Consequently, any technic which limits the amount of instruments required in the mouth greatly facilitates operative procedures.

Electrosurgical cutting currents also facilitate the dissection of adherent tumors of the neck, particularly metastatic glands, which have been given heavy irradiation preoperatively. The clamp coagulation method of hemostasis makes it possible to control hemorrhage from vessels which often cannot be tied. This technic enhances the completion of hemostases when large numbers of hemostats are placed upon blood vessels in the skin and fascia in the neck.

In previous years satisfactory postoperative *nutrition* was difficult to maintain following extensive operations upon the mouth, tongue, lip or jaw. Many patients actually starved to death for lack of proper food. Modern knowledge of nutritional needs of vitamins, minerals, electrolites, as well as proteins, fats and carbohydrate intake makes it possible to keep the patients on a perfectly normal food intake even though they are unable to swallow. Adequate fluids and foods are given either through intranasal tube or by gastrostomy. The latter has been rarely necessary in our practice as most patients can be fed adequately by the intranasal route.

With the marked advances in *plastic surgery* it is now possible to remove extensive growths from the head and neck, including portions of the jaws, with the expectation of restoring the patient to fairly normal function. Some times these plastic procedures are performed at the time the neoplasm is removed. In other cases the plastic procedures are delayed until there is reasonable assurance that the cancer will not return, or until the tissues are ready to receive skin flaps from other portions of the body. Frequently it is impossible to replace all the bone and soft tissues that have been removed, such as

the hard palate or superior maxilla. *Prostheses*, often carrying teeth, make it possible for a patient to swallow and talk practically normally. Frequently these prosthetic appliances are used also to replace part of the lower jaw or an eye. Not uncommonly temporary prostheses are made prior to operation for insertion in the mouth at operation to maintain jaw position for a week or ten days postoperatively allowing the patient to swallow and talk normally. In this way he is relieved of the necessity of prolonged intranasal feedings until healing is complete when he is fitted with a permanent appliance. The hope of plastic reconstruction or the adaptation of a proper prosthesis gives the surgeon courage to perform and the patient courage to undergo what a few years ago were almost unheard of operations.

Grant E. Ward, M.D.

McClure and Lam studied over 150 cases of cancer of the lip or face and found that prophylactic dissection of non-palpable lymph nodes of the neck does not apparently improve the prognosis of these patients. Of course, all palpable, enlarged nodes and all regional lymph nodes should be removed, if possible, at the same time that the primary malignant lesion is excised; but in early cases of lip cancer, radiation of the lymphatic areas may suffice. In many cases the only indicated treatment is careful observation. If and when the cervical glands become palpable, excision, radiation or both are indicated. (*Richard A. Leonardo, M.D.*)

HYDATIDIFORM MOLE AND CHORIONEPITHELIOMA

HYDATIDIFORM mole is a relatively rare condition, its incidence being approximately 1 in 2,000 pregnancies. Chorionepithelioma, however, is exceedingly rare, and there are even many large clinics in which not a single case has been encountered. Moreover, if one looks over the cases reported in the literature, it is quite evident that in many of these there have been errors of interpretation, and that a not inconsiderable proportion were instances of benign although perhaps proliferative types of hydatidiform mole.

As a matter of fact there is no field of pathology in which mistakes in diagnosis are more common than in this, and such errors have all too often led to unnecessarily radical plans of treatment. General pathologists have little opportunity of familiarizing themselves with the characteristics of such a rare lesion as chorionepithelioma as well as its differentiation from benign hydatidiform mole. Further elements of confusion have been added in recent years through overemphasis on the diagnostic and prognostic significance of the biologic tests which, valuable though they are, should be looked upon only as adjuvants to the clinical evaluation of such problems.

While the frankly benign and the frankly malignant cases offer no difficulty in microscopic differentiation, there is a borderline group in which there will be uncertainty in the minds of even highly trained and experienced gynecological pathologists. To this intermediate group have been applied such designations as malignant mole or chorio-adenoma destruens. Efforts at correlating the histologic and clinical characteristics of such moles, chiefly on the degree of trophoblastic proliferation or on the degree of apparent anaplastic activity, have thus far not been satisfactory; this includes the recent classification suggested by Hertig.

The difficulty lies in the fact that even a normal trophoblast exhibits many of the characteristics commonly associated with malignancy. It destroys and invades the maternal tissues, it penetrates the blood vessels and it even undergoes a species of normal or physiologic metastasis as can be seen in the process of deportation of trophoblastic masses and villi to the lungs; this probably occurs in all normal pregnancies.

However, the maternal tissues, presumably through the agency of the decidual cells, exhibit a defensive mechanism which holds the trophoblastic encroachment within normal limits. A deficiency in this defensive mechanism may be more important than abnormal trophoblastic activity in the explanation of the abnormal vascular penetration which characterizes the so-called malignant mole or chorioadenoma destruens. On the other hand, it is quite likely that it is this defense mechanism, the nature of which we do not know, that explains the spontaneous local regression and even complete cures which have been reported in occasional cases of genuine chorionepithelioma.

There is now general appreciation of the fact that a high quantitative gonadotrophic titer is not by any means of decisive diagnostic importance, chiefly because this diagnostic problem usually arises at that phase of pregnancy in which there is normally a high peak of gonadotrophin production, and this may at times be just as high or higher than that seen in some cases of hydatidiform mole. Much more important is the biologic follow-up after evacuation of the mole although this, too, offers possible pitfalls.

The persistence of a high titer is suggestive, but not by any means does it necessarily point to malignancy in the form of chorionepithelioma. Before thinking of radical measures it is always better to do

a repeat curettage, especially as this generally can be carried out more safely and thoroughly now that the uterus is smaller and firmer. Often the curettage will reveal further molar tissue, but sometimes not. In either case if a high or increasing titer persists beyond this, one is fully justified in proceeding with hysterectomy.

This may reveal a definite chorionepithelioma but in most cases it will not. More often microscopic examination of the removed uterus reveals that the high gonadotrophic titer has been due to trophoblastic tissue, often with large molar villi, deep in the uterine wall and sinuses. Such rests are inaccessible to the curette. However, the hazard in such cases is so great that the radical procedure is fully justified. Furthermore, there is always the possibility that such trophoblastic rests may give rise to later intramural chorionepithelioma. I need not emphasize the importance of other diagnostic procedures, especially roentgen examination of the chest, nor need I elaborate on certain vagaries of the biologic test, such as the completely negative phases seen in the occasional case of chorionepithelioma.

These random comments are set forth merely to call attention to the many problems still surrounding this general subject along pathologic, diagnostic and therapeutic lines. It was for this reason that one of our national organizations, the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, recently created the Albert Mathieu Chorionepithelioma Registry which was announced in the *American Journal of Obstetrics and Gynecology* and a number of other medical publications. The accumulation, study and follow-up of the cases submitted to this registry should in time yield worth while results in the elucidation of some of the problems which have just been indicated. It is sincerely hoped also that gynecologists and obstetricians throughout the country will join in this cooperative undertaking by sending to the registry material and clinical data from cases of hydatidiform mole and chorionepithelioma from their own practices and clinics.

Emil Novak, M.D.

Original Articles

CLEAVAGE PLANES IN RECONSTRUCTIVE VAGINAL PLASTIC SURGERY*

J. V. Ricci, M.D., C. H. Thom, M.D. and W. L. Kron, M.D.
New York, New York

A RECOGNITION of the basic relationships between the fibromuscular elastic wall of the vagina as a central organ and the juxtaposed urethra, bladder, cervix, rectum, anoperineal body and cul-de-sac peritoneum is indispensable in reconstructive vaginal surgery. The vagina as a *point d'appui* is directly involved in surgery for relaxations, lacerations, fistulous formations and descent of the urethrovesico-anorecto-genital parts.

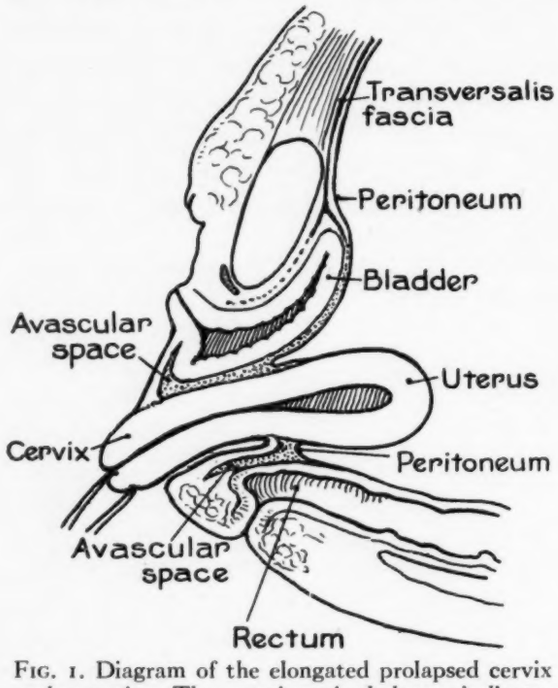

FIG. 1. Diagram of the elongated prolapsed cervix under tension. The anterior stippled area indicates the cleavage plane which separates the bladder from the vaginal wall and cervical surface. This anterior cleavage plane or space is avascular and loosely packed with areolar tissue. The posterior stippled area indicates the cleavage plane between the vaginal wall and rectal wall and cul-de-sac peritoneum.

These basic relationships are clear: (1) There is a complete fusion between the anterior vaginal wall and that of the urethra throughout its entire length. Because of this fusion, surgical separation of these two structures can be accomplished only by blunt dissection and this leads to an unavoidable ooze. (2) There is a clear-cut line of separation, an areolar cleavage plane, between the anterior vaginal wall and the juxtaposed bladder wall from the urethrovesical area to the point of fusion of the vagina and the cervix. This areolar cleavage plane extends beyond this point and separates the bladder wall from the cervicofundal surface up to the vesico-uterine peritoneal reflection. These definite lines of separation, or areolar cleavage planes, lead to a bloodless separation of the bladder from the vaginal wall and from the cervicofundal surface. (3) There is a complete fusion of the posterior vaginal wall with the short perineo-anal body. Separation of these structures which can be accomplished only by blunt dissection leads to an unavoidable ooze. (4) There is a clear-cut line of separation, an areolar cleavage plane, between the posterior wall of the vagina and the wall of the rectum, extending from the anorectal area to the cul-de-sac peritoneal reflections. (Fig. 1.) The presence of this areolar cleavage plane permits a bloodless separation of these two organs. *But in no instance does a surgically useful fascia line or encase the vagina or any of the juxtaposed organs.*

In the normal state the anterior vaginal

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wall meets and fuses with the cervix at an obtuse angle, the degree of angulation increasing proportionately to the amount of retrodisplacement of the normally posed uterus. In the presence of a prolapsed, elongated cervix the vaginal wall meets and fuses with the cervix at an acute angle. At the apex of this angle, the bladder wall, instead of coming to a sharp point, circles away from this vaginocervical angulation, thus creating a clear space or blind pocket thinly packed with scattered areolar fibers. A similar blind pocket in both the normal and prolapsed state exists between the cul-de-sac peritoneum as it swings cephalad to cover the rectosigmoid and the posterior vaginal wall as it swings pedad from its point of fusion with the posterior cervix. This pocket is packed with a loosely felted areolar mesh. A knowledge of these relationships and utilization of precise methods of approach to avascular spaces and cleavage planes shortens operating time, minimizes bleeding and, in brief, simplifies vaginal plastic surgery.

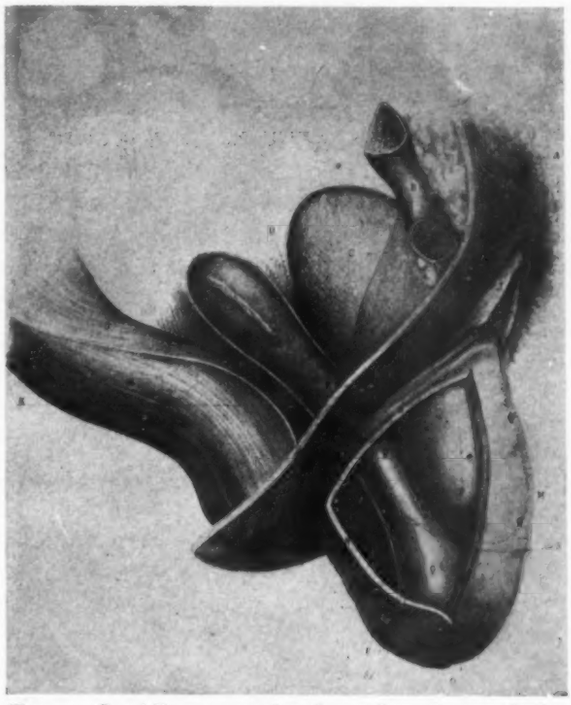


Fig. 2. Semidiagrammatic view of prolapse of the elongated cervix. The creation of a triangular window by excising the lateral vaginal wall area shows the contour of the distended bladder at the cervicovaginal point of fusion. Noticeable also is the lack of any connection of the bladder to the cervix and vaginal wall. The small dark area between bladder and the cervicovaginal fusion point is the anterior avascular areolar space. Below the elongated cervix appears the posterior avascular areolar space. (From P. C. Huguier. *Mém. Acad. Imp. de med.*, vol. 23, plate II, 1859.)

HISTORICAL BACKGROUND

Vague recognition of a cleavage plane and also of cellular tissue between the bladder and the cervicofundal surface was apparent in the description of a vaginal hysterectomy for a carcinomatous uterus by J. N. Sauter[1] in 1822. He made a circular incision around the cervix, separated the vaginal cuff from the cervical substance, introduced two fingers into the opening and "tore" the cellular tissue. J. C. A. Récamier,[2] operating for a similar lesion in 1829, made a transverse incision from right to left over the vaginal wall as it fused with the cervical substance and "pushed aside" the cellular tissue which "united" the vagina and the bladder with the surface of the uterus. These intrepid operators were dealing with a cleavage plane between the bladder and the cervicofundal surface, rather than the plane between bladder and vaginal wall. Although he did not set out to do so, the first actually to expose the cleavage plane between the vaginal wall and the bladder was J. Marion Sims[3] (1856). He had to obtain permission from the consulting board of The Woman's Hospital in the State of New York to excise the sagging anterior vaginal wall and the base of the bladder in a woman of thirty with an "enormous cystocele." With the patient in the left lateral position Sims hooked the center of the sagging wall, held it under tension and placed a crescentic-shaped clamp at the base of the bulge. This clamp made especially for the purpose resembled Ricord's phymosis clamp. He cut the redundant tissue below the clamp but, contrary to expectation, noted that he had removed the hypertrophied vaginal wall, entered a clear-cut cleavage plane and left the bladder wall intact. Believing that hemorrhage and abscess formation might result, Sims considered this method of removing a sacculated portion of the vaginal wall too formidable. The existence of cleavage planes between the vaginal wall and the bladder and between the bladder and the cervicofundal surface was clearly noted by P. C. Huguier[4] (1859) who grasped the redundant vaginal wall (cysto-

cele) and passed four pins through the cellular tissue between the vaginal wall and the base of the bladder. To avoid injury to the bladder he passed his little finger into that viscus through a dilated urethra to act as a guide. (Fig. 2.)

Accompanying Huguier's lengthy article is the first accurate portrayal of the relationship of the bladder to the elongated cervix and vaginal wall in prolapse and cystocele. This remarkable semidiagrammatic portrayal, according to Huguier, was based on a presentation by J. Cloquet.[5] In 1872 T. Gaillard Thomas[6] described his method of narrowing the vagina and, in addition, gave details of the operative minutiae involved in entering the cleavage plane between the vaginal wall and the bladder. Thomas was the first gynecologist to use the term *loose areolar tissue* though *areolar* was commonly used by anatomists. Furthermore, he specifically stated that he removed the entire thickness of the vaginal wall. A. Farre,[7] anatomist and lecturer in obstetrics, stated in 1859 that the anterior vaginal wall was connected with the urethra and the base of the bladder by areolar tissue. To facilitate separation of the anterior vaginal wall from the juxtaposed bladder, Gaillard Thomas invented a special instrument on the principle of the glove stretcher. Neither S. Choppin[8] (1861) of New Orleans, who performed the first vaginal hysterectomy for prolapse, nor A. Patterson[9] (1876) of Glasgow, who performed the second operation of this kind, mentioned any cleavage planes in the brief descriptions of their respective technics. The first to advise lifting the entire thickness of the vaginal wall from the cervix in the repair of a cystocele was B. E. Hadra[10] of Texas in 1888. G. Winter[11] in discussing the pathology of prolapse proposed detaching the bladder from the vaginal wall by making an oval incision over the anterior vaginal wall (1896). R. Gersunny[12] in 1897 stated that in cases of cystocele he made a median incision through the anterior wall of the vagina, beginning from the anterior lip of the os uteri and reaching into the bulbus urethrae. This enabled him to detach the anterior vaginal wall from the bladder. Max Sänger[13] in his discussion of this subject called attention to the fact that he had advised detaching the bladder from the vaginal wall in 1892 and had reported his views before the International Congress of Gynecologists at Brussels.

H. F. Kreutzmann[14] considered it essential to free the bladder from the uterus as well as from the vagina by a median incision (1900). He had originally made this communication before the California Academy of Medicine in 1895. Equally clear is I. S. Stone's[15] statement that the bladder has a thin layer of cellular tissue between its posterior and inferior surfaces and that this cellular tissue makes it possible for the operator to separate the bladder from its attachments. In 1902 Kreutzmann[16] reiterated his views on the cellular separation between vaginal wall and bladder. The abandonment of denudation operations led to the popular method of "insinuating" a scissors from the cervix to the urethral orifice in order to separate the "mucosal flaps" from the vaginal wall and thus expose the fascia (the inverted T incision). Obviously, this incision merely split the anterior vaginal wall leaving the outer layer of fibromuscular elastic tissue on the mucosal side of the vagina and the inner layer on the bladder musculature. On this point Bissell[17] said that the common method of approach (by longitudinal incision through the anterior vaginal wall from a point near the "base of the urethra" to a point near the junction of the vaginal wall and the cervix) followed artificial lines of dissection and did not lead with any degree of precision into the cleavage plane (1930).

The first to abandon the haphazard methods of separating vaginal wall from rectal wall was D. Bissell[18] who began to expose the "natural" rectovaginal cleavage planes (his cellular area) in 1918. About 1924 Bissell began to expose the "natural" cleavage plane between the vagina and bladder by elevating the anterior vaginal wall just above its cervical incision and incising its entire thickness, thus exposing the cellular space between the bladder and the cervicofundal surface. In 1928 B. H. Goff[19] featured this procedure in his article on repair of the damaged pelvic floor. In 1930 R. A. Hurd[20] stated before the New York Obstetrical Society that Bissell had demonstrated to him an approach to the "clear space" between the vaginal and the bladder walls, which approach could not be too warmly advocated because of its simplicity and its comparative freedom from "liability of bladder injury." In the discussion following Hurd's article Bissell referred to his own method of reaching the line of cleavage and added that he was convinced that there

was no definite fascial layer which could be isolated and utilized for surgical purposes. E. Hesketh Roberts[21] in 1931 described and depicted diagrammatically his method of approach to what he called the layer of loose intervisceral avascular tissue in the avascular space. In 1933 the Bissell method of exposing the vesicovaginal cleavage plane was described by Goff[22] and realistically portrayed by E. M. Freret.

According to R. H. Paramore,[23] Th. Addis Emmet in 1871 first began to believe that the pelvic fascia could be used to support the uterus. By 1883 he had come to attach greater importance to the fascia, thinking that it could also be used to support the posterior vaginal wall. Emmet[24] was the first to mention the fascia as an essential factor in vaginal plastic surgery in his address to the members of the American Gynecological Society in 1883. This novel idea elicited harsh and caustic comment in the discussion to his article.

A search for a supportive visceral pelvic fascia through the years has rendered vaginal reconstructive surgery inconclusive and has generated an excess of anatomic terms and a medley of operative technics. Vaginal plastic surgery has been seriously hampered by the assumption that supportive fascial molds encase and hold the bladder, the vagina, the urethra and the rectum in place; that a cystocele, a urethrocele and rectocele are hernias through rents in the vesicovaginal, urethrovaginal and rectovaginal fascias. These are misconceptions. Considering the differences in anatomic relationships between the vagina and the urethra and between the vagina and the bladder—the marked fixation of the urethra to both the pubic arch and the vaginal wall and the complete separation of the bladder from all surrounding structures—it is highly doubtful that such an entity as a urethrocele can occur. Nothing has been more pernicious in vaginal plastic surgery than the flap-splitting of the vaginal wall which has led to the creation of a fascia; nor the plunging or "insinuating" of closed scissors into the substance of the vaginal wall which has, in most instances, led to the creation of false planes, leaving part of the vaginal wall either on the bladder or on the rectum. Pernicious is the use of "gauzed finger" displacement of an organ, almost always an indication that the operator is not in the right plane and is anatomically lost. Equally misleading is the introduction of a sound into the bladder to locate its lowermost wall. The bladder is a movable organ and the tip of the instrument can displace it down to the very point of fusion between the vaginal wall and the cervix.

Vaginal plastic surgery is reconstructive surgery, demanding neatness, accuracy and symmetry in its execution. No reconstruction of the genital parts is possible without an initial "destructive" operative phase. This entails incising and excising of tissues, exposing and displacing of organs and it is in the execution of this phase of plastic surgery that serious blood loss may occur unless the natural cleavage planes are utilized. An appropriate position of the patient, best suited to display the lesion and to facilitate the operation, is essential. The sterile drapery must be so arranged as to remain securely in place throughout the operation. Suitable specula and the lateral suturing of the labia minora will add to the proper exposure. The comfort of both the surgeon and his assistants is essential since vaginal plastic procedures are tedious and frequently extended into the second operative hour. Precision in minor details adds to better end results. Each assistant must be schooled in his appointed task. A bloody operative field, strewn with bits of tissue, cluttered with useless clamps and littered with dangling unnecessary sutures displays surgical clumsiness, leads to confusion and prolongs operative time.

The technics to be described are applicable in cases presenting a descensus of the elongated cervix with or without a cystocele and in cases with a lacerated or relaxed perineum with or without a rectocele. In instances of normally posed cervix and anterior vaginal wall, approach to the cleavage plane may easily be gained by bisecting the anterior lip of the cervix

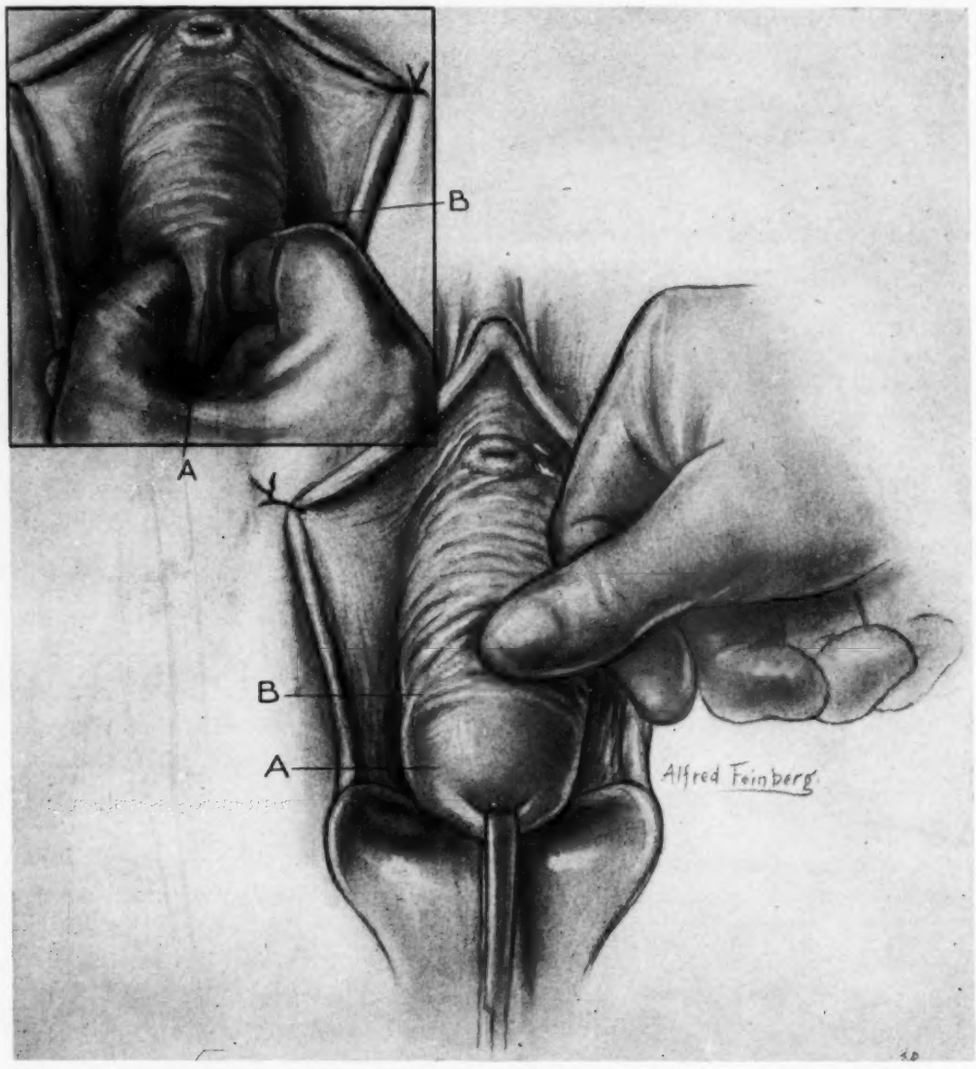
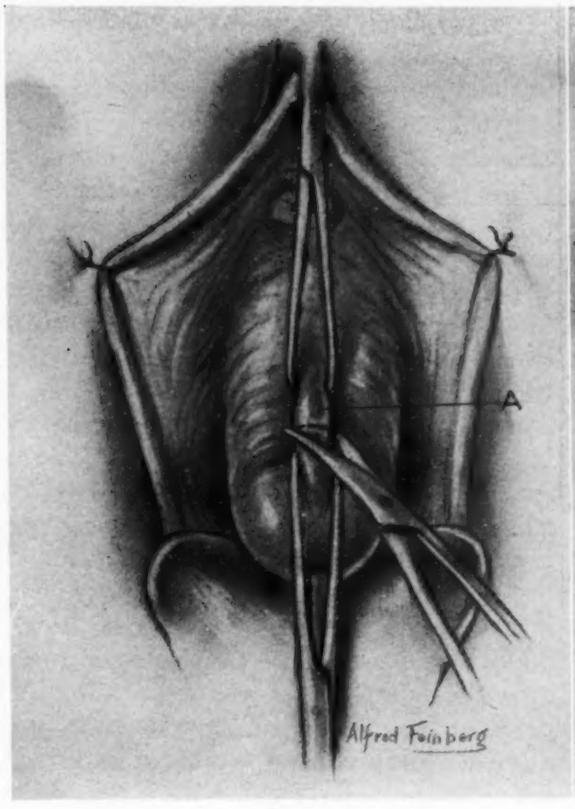


FIG. 3. The smooth surface (A) indicates portion of the vaginal wall completely fused with the cervix. The area marked (B) showing vaginal rugae indicates beginning of cleavage plane which separates the vaginal wall from the anterior surface of the cervix. This wall is massaged upward toward the urethra with swings of the thumb. *Insert:* The entire thickness of the vaginal wall above the area is grasped with fingers and elevated. This area is rubbed between fingers to "increase" separation.

and the vaginal wall exactly in midline up to the internal os. That is best accomplished by using a straight scissors and inserting one blade of the scissors into the cervical canal.

TECHNICS

Method of Approach to the Avascular Areolar Cleavage Plane between the Anterior Vaginal Wall and the Bladder Wall and between the Bladder Wall and the Cervico-fundal Surface up to the Vesico-uterine Peritoneal Fold. The anterior vaginal wall is placed on tension by applying traction to the cervix. This is best done by grasping both lips of the cervix with short tenacula exactly in midline. That part of the anterior vaginal wall close to the cervix is gently rolled between the index finger and thumb several times. The wall is then massaged upwards toward the urethra with "swings" of the thumb. (Fig. 3.) These initial steps are not essential although their habitual use has convinced the authors that the planes of separation thereby become more apparent. On



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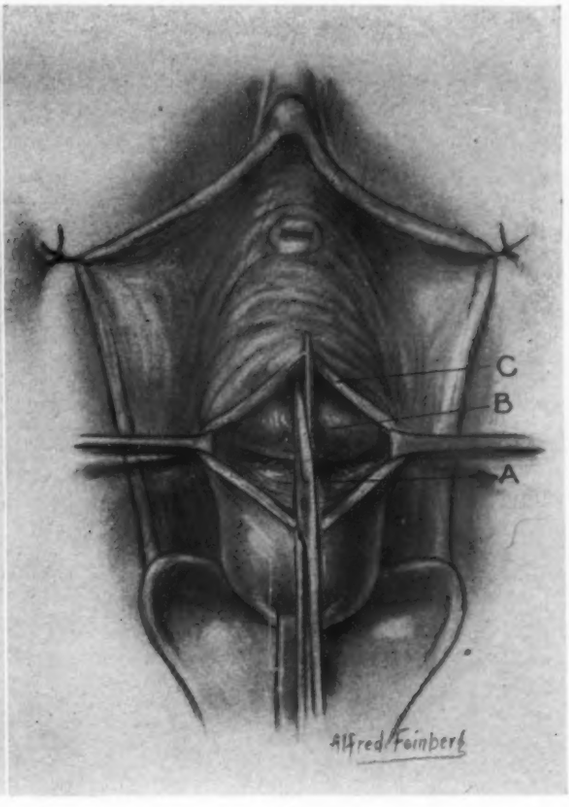

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FIG. 4. The doubled thickness of the entire vaginal wall is grasped between two Allis clamps and held taut; it is cut transversely with one stroke of the scissors. This incision properly executed at the proper level leads directly into the anterior avascular space or cleavage plane.

FIG. 5. Exposure of the avascular areolar cleavage plane or space. At mid-point of the initial transverse incision of the entire thickness of the vaginal wall a longitudinal incision is begun and continued upward again including the entire thickness of vaginal wall. This incision ends at the point of fusion between vagina and urethra. A, indicates surface of the cervix; B, indicates free bladder musculature; C, indicates the entire thickness of vaginal wall.

close inspection it is possible to note where the fusion between the vaginal wall and the cervix ends and the avascular space begins. The fused portion of the vaginal wall is smooth and lacking in rugae. At this point, which is usually about ¾ inch above the external orifice of the cervix, the vaginal wall is grasped. As a matter of fact, the clamp grasps the reduplicated layers of the entire thickness of the vaginal wall. (Fig. 4.) Another clamp is placed ¼ inch above this first clamp. Between these two clamps the entire thickness of the vaginal wall is incised with a curved scissors, the tip of the scissors pointing perpendicular to the cervix. If this incision is made at the correct level, an avascular clear space (Fig. 5) or pocket-like compartment appears, bringing into view the lowermost tip of the bladder and a few shreds of areolar fiber. The bladder can be displaced instantly from the vaginal wall and from the cervicofundal surface without effort and without loss of blood by introducing the index finger into this pocket. The bladder separation ends at the urethrovesical junction and at the vesico-uterine peritoneal fold. It is essential to incise the entire thickness of the vaginal wall and to enter the proper cleavage area. By this procedure such artefacts as pillars of the bladder, pubocervical ligaments, pubocervical fascia and uterovesical ligaments will not be "created" to plague the operator. If the tip of the bladder is not visible and if the index finger does not displace the

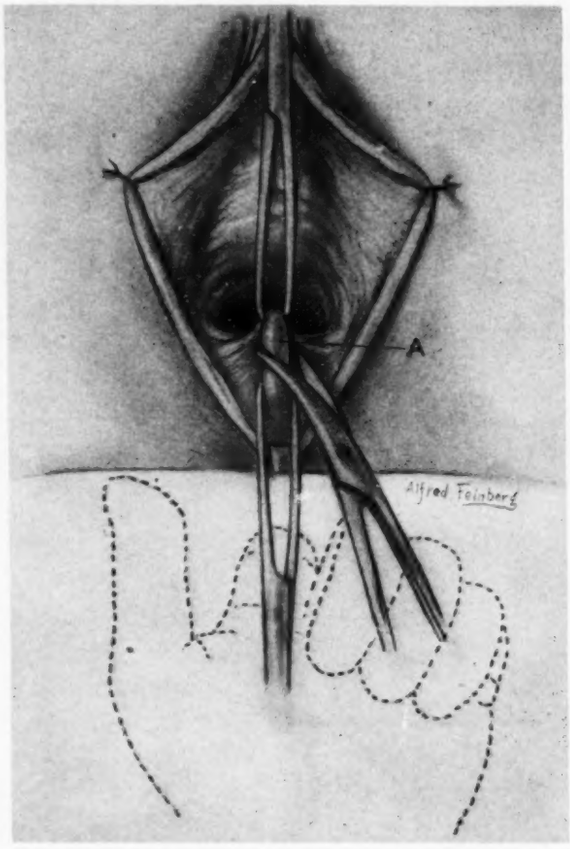
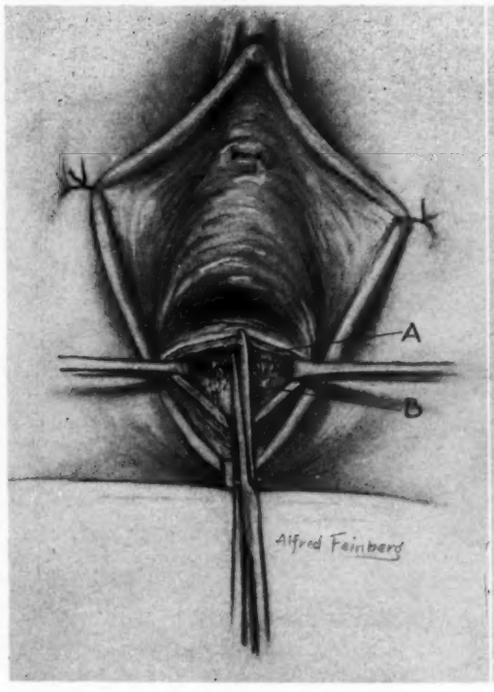


FIG. 6. The posterior vaginal wall at its point of fusion with the anoperineal body is grasped with two Allis clamps and elevated. The index finger is inserted in rectum for added guidance and safety. A transverse incision is made through the entire thickness of the vaginal wall. At point marked (A) there is no cleavage plane.

bladder instantly at the slightest pressure from the surface of the vaginal wall and the cervicofundal surface, the operator has incised too close to the cervix and has missed the avascular space. To gain the space from this point, it is best to grasp the cut surface of the vaginal wall at both ends of the incision with Allis clamps. These instruments are held taut and parallel with the floor. With a straight scissors the presenting cut margin of the vaginal wall is incised exactly in midline. This procedure will lead the operator into the avascular areolar cleavage plane. The incision is then continued up to the urethrovaginal junction where the cleavage plane ends. To go beyond this wall may injure the sphincteric urinary control.

Method of Approach to the Avascular Areolar Cleavage Plane between the Posterior Vaginal Wall and the Wall of the Rectum. In dealing with this area it must be recognized that there is complete fusion between the posterior vaginal wall and the anal wall —the perineal body; and on that account, a blunt separation of the vaginal wall from the anal wall must be completed before the rectovaginal plane of separation can be reached. Landmarks are essential in the description and depiction of surgical technics but unfortunately on the vaginoperineal body they may be difficult to locate owing to the irregularities of obstetrical trauma. The essential landmarks in this instance are the hymenal ring, particularly the last hymenal caruncle, the fossa navicularis and the fourchette. Even in a markedly relaxed perineal body with no break nor scar in the mucocutaneous area these landmarks are visible; but in a perineal body scarred by a laceration or by a mediolateral episiotomy these landmarks are either none too clear or even completely effaced.

With the patient in the lithotomy position the index finger of the left hand is introduced into the rectum; a towel is clamped above the anal opening for aseptic precautions. The purpose of this finger is to follow the tip of the scissors as it nibbles away at the vaginal wall fused to the perineal body. (Fig. 6.) One Allis clamp grasps the vaginal wall just above the mucocutaneous junction and another is placed a ¼ inch above it. With a curved scissors pointing almost perpendicular to the anal canal the vaginal wall is cut transversely. The two clamps are removed and both ends of the incision are grasped, including in the bite the ever present bleeding points. This initial transverse incision, since it is made in the perineo-anal area, will not expose the avascular areolar rectovaginal plane. The cut surface of the vaginal wall is held taut by pulling the two lateral clamps parallel to the floor. With a straight scissors pointing exactly in midline and using the urethral orifice as a guide, the vaginal wall is nibbled. Every ¼ inch of incised vaginal wall is grasped with



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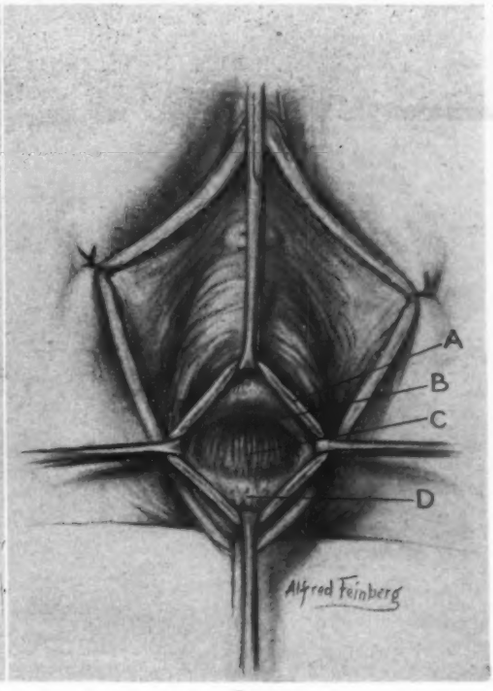

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Fig. 7. At mid-point of the initial transverse incision a longitudinal incision is begun and continued upward including the entire thickness of the vaginal wall until the posterior avascular areolar cleavage plane or space is reached. A, indicates entire thickness of vaginal wall; B, indicates anoperineal body.

Fig. 8. Exposed posterior avascular areolar cleavage plane or space. A, entire thickness of vaginal wall; B and C, muscular fibers of the rectum; D, anoperineal body.

Allis clamps the better to expose the surface and to control bleeding. The nibbling process is continued until the anoperineal body is completely dissected from the vaginal wall; and at the anorectal junction a clear-cut avascular areolar packed cleavage plane is reached. (Figs. 7 and 8.) At this point with one stroke of the finger the entire rectal wall is completely separated from the posterior vaginal wall up to the peritoneal reflections. This technic will give the clearest macroscopic evidence that a rectovaginal fascia or musculofascial sheath does not exist in this area.

It is possible to make the initial transverse incision of the posterior vaginal wall just above the anoperineal area. This will make nibbling unnecessary, avoid some bleeding and will lead directly into the avascular rectovaginal cleavage plane. Denudation of the mucocutaneous area may be reserved for the second step. But in this technic care must be taken to avoid undue shortening of the posterior vaginal wall.

Method of Approach to the Cul-de-sac Peritoneum. The posterior lip of the cervix is grasped with a tenaculum and the cervix pulled upward and outward. A noticeable dimple marks the beginning of the avascular areolar cleavage plane and the point of fusion of the vaginal wall with the cervical substance. (Figs. 9 and 10.) At this point the entire thickness of vaginal wall is grasped by an Allis clamp. One-quarter inch below another clamp is applied and between the two a curved scissors with the curvature pointing upward away from the rectum is used to cut the entire thickness of the vaginal wall. These two clamps are removed and the cut margins of the vaginal wall are grasped to stem the bleeding. Invariably with this type of incision made at the point described the avascular areolar packed cleavage plane permits index finger separation of the areolar mesh, exposes the cul-de-sac peritoneum and displaces the rectal wall.

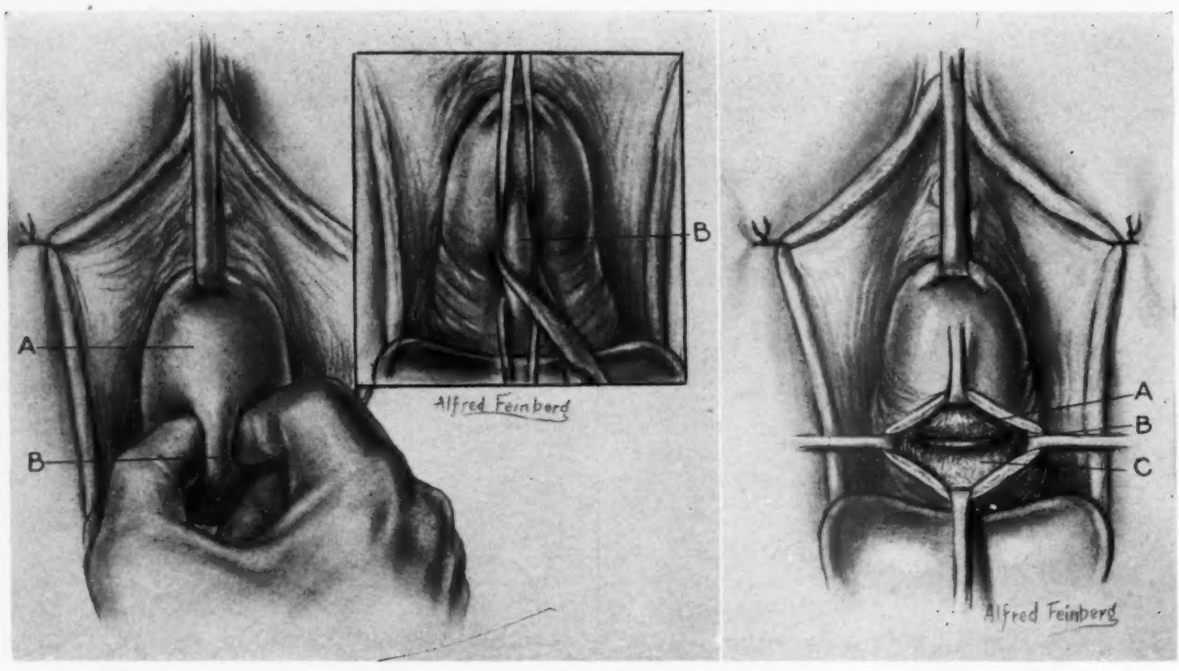

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FIG. 9. Posterior surface of the cervix is exposed. A, indicates area of complete fusion of vaginal wall and cervical substance; B, indicates loose vaginal wall which is free from cervix and rectal wall. *Insert:* Vaginal wall marked. B, is caught between two clamps and incised. The incision should involve the entire thickness of the vaginal wall. FIG. 10. Exposed avascular areolar cleavage plane or space in the cul-de-sac area. A, posterior surface of cervix; B, beginning cul-de-sac peritoneal bulge; C, inner aspect of vaginal wall and shreds of areolar tissue.

CONCLUSIONS

1. The vaginal wall is completely fused with the urethral wall anteriorly and the anoperineal body posteriorly; because of these fusions, no cleavage planes or lines of demarcation exist between the vagina and these two structures. Separation of the vaginal wall from the urethral wall and the anoperineal body can be accomplished only by blunt dissection and this procedure is attended by an unavoidable ooze.

2. Between the anterior vaginal wall and the juxtaposed bladder wall there is an avascular areolar cleavage plane beginning at the urethrovesical area to the point of fusion of the vaginal wall with the cervix. A similar avascular areolar cleavage plane exists between the bladder wall and the juxtaposed cervicofundal surface ending with the vesico-uterine peritoneal fold. The existence of these cleavage planes permits a bloodless separation of the bladder from both the vagina and the cervicofundal surfaces.

3. Between the posterior vaginal wall and the juxtaposed rectal wall there is an avascular areolar cleavage plane beginning at the anorectal junction and ending at the cul-de-sac peritoneal reflection. The existence of this cleavage plane permits a bloodless separation of the posterior vaginal wall from the juxtaposed rectal wall.

4. Neither in the normal nor relaxed state is there a surgically useful fascia lining or encasing the vagina or any of the juxtaposed organs.

5. In cystocele and prolapse of the elongated cervix the bladder wall circles away from the acute angulation made by the fusion of the anterior vaginal wall with the anterior cervical substance, accentuating an avascular space or pocket containing scattered areolar fibers.

6. In both the normal and prolapsed state between the cul-de-sac peritoneum and the juxtaposed portion of the posterior vaginal wall, as it swings pedad from its point of fusion with the posterior surface of the cervix is an avascular space or pocket filled with a loosely felted areolar mesh.

7. Technics are adequately described for the accurate approach to and exposure of the cleavage planes and avascular spaces essential in vaginal plastic surgery.

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EFFECT OF HYDROGEN SULFIDE UPON THE BALLOONS OF INTESTINAL DECOMPRESSION TUBES

AN EXPERIMENTAL STUDY*

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IN a previous publication[1] we attempted to focus attention upon the fact that all balloons of intestinal decompression tubes were permeable to intestinal gases. We noted at that time that latex balloons were five times as permeable to carbon dioxide gas as were neoprene rubber balloons. Our studies at that time were carried on with carbon dioxide because of the high degree of permeability of rubber to this gas, and because carbon dioxide is present in the gastrointestinal tract of a patient with intestinal distention in a far higher percentage than in atmospheric air. Because of this disproportion between the percentage of carbon dioxide in the bowel, which ranges[2,3] from 4 to 18 per cent, and within the balloons of intestinal tubes which normally contain a small amount of air with a carbon dioxide percentage of 0.03 per cent, the carbon dioxide tends to diffuse from within the bowel into the balloon until there is an equalization of carbon dioxide pressures. As we pointed out, this accumulation of gas within the balloons of intestinal tubes might be a source of great danger to the patient being intubated.

Hydrogen sulfide is another gas not found in the air but often found within the gastrointestinal tract of patients with bowel obstruction. The percentage of hydrogen sulfide has been reported[2] as ranging from 2 to 12 per cent in some cases of intestinal distention. For this reason a study of the effect of this gas upon the balloons of intestinal decompression tubes was imperative since this gas, too, would diffuse into the balloons.

Mitchell[4] in 1831 in his studies on the penetrativeness of gases noted that rubber was highly permeable to hydrogen sulfide. In his studies Mitchell found that hydrogen sulfide permeated rubber far more readily than carbon dioxide.

Because of these facts we carried out experimental studies to determine the degree of permeability of latex and neoprene rubber balloons from intestinal decompression tubes to hydrogen sulfide.

METHODS

Experiment No. 1. Five balloons were used in this experiment. Hydrogen sulfide was passed into the pressure chamber containing these balloons for forty-eight hours. The pressure of the hydrogen sulfide at the beginning of the experiment was 33 mm. of mercury for the first twenty-four hours and 10 mm. of mercury for the second twenty-four hours. Glass beads in approximately the same volume were used in the balloons not containing mercury to keep the walls apart. The balloons used were: Harris balloon with mercury; (2) Harris balloon with beads; (3) Miller-Abbott with mercury; (4) Cantor latex with mercury and (5) Cantor latex with beads.

Results. At the end of forty-eight hours no gas was found in any of the balloons.

Comment. This unexpected result created two questions: First, was Mitchell correct? Is rubber highly permeable to hydrogen sulfide? Is it possible that no hydrogen sulfide could diffuse into the balloons? The second possibility was: If rubber is permeable to hydrogen sulfide, can it be so highly permeable that a rubber balloon of latex cannot hold the hydrogen sulfide gas? With these possibilities in mind

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we proceeded to experiment further in order to decide these questions definitely.

Experiment No. 2. Four balloons were used in this experiment. Hydrogen sulfide was passed into the pressure chamber containing the balloons at a pressure of 100 mm. of mercury for twenty-four hours. The balloons were sealed at their mouths. The balloons used were: (1) Harris balloon with beads; (2) Cantor latex balloon with beads; (3) Cantor latex balloon with mercury and (4) Harris balloon with mercury.

Results. At the end of twenty-four hours the following results were obtained: (1) The Harris balloon with beads took up 60 cc. of hydrogen sulfide; (2) the Cantor latex with beads took up 8 cc. of hydrogen sulfide; (3) the Cantor latex with mercury took up no gas. The balloon was discolored black; there was a black deposit within the balloon and the walls were adherent. (4) The Harris balloon with mercury took up no gas; the balloon was discolored black and the walls were adherent.

Comment. This experiment is evidence for the fact that latex balloons are permeable to hydrogen sulfide. In the presence of mercury, however, a mercuric sulfide forms and the walls of the balloon become discolored and adherent with the result that no cavity remains to hold the gas.

Knowing now that latex is permeable to hydrogen sulfide, we must determine the degree of permeability in order to explain the results of Experiment No. 1. If latex is highly permeable to hydrogen sulfide, the explanation for the results in Experiment No. 1 would be obvious.

Experiment No. 3. One balloon was used in this experiment whose purpose was the determination of the speed of outward diffusion of hydrogen sulfide from within the balloon of a Harris tube. Therefore, a Harris tube balloon was filled with hydrogen sulfide. A pressure of 5 mm. of mercury of hydrogen sulphide was found to be sufficient to distend the balloon but not overstretch it. We avoided overstretching the balloon because that would result in a thinning of the wall and hence would not give a true outward gas diffusion reading.

Result. At the end of *three minutes* a definite loss of hydrogen sulfide was noted and a definite wrinkling of the balloon appeared. At the end of *ten minutes* the pressure of the hydrogen sulfide in the balloon had dropped to 3 mm. of mercury. The balloon had lost 50 per cent of its gas. At the end of *fifteen minutes* the pressure had dropped to 2 mm. of mercury and the balloon had lost 75 per cent of its gas. At the end of *twenty-two minutes* the balloon was almost completely empty.

Comment. Since the permeability of rubber to a specific gas is the same under the same conditions whether the gas diffuses outward from within the balloon or diffuses from the outside into the balloon, it becomes quite apparent that latex balloons are very highly permeable to hydrogen sulfide confined within them.

Experiment No. 4A. Nine balloons were used in this experiment to determine the speed of diffusion of hydrogen sulfide out of various kinds of balloons. The balloons used were: (1) Harris balloon with beads. This balloon had previously been perfused with hydrogen sulfide for four days. The rubber had lost its normal shiny translucent appearance and was not as elastic as when new. The rubber was further affected by the hydrogen sulfide by becoming milky white and opaque. This balloon was filled with hydrogen sulfide until its walls were tense but not stretched. (2) Harris balloon with mercury which had been previously perfused with hydrogen sulfide for four days. This balloon was discolored black and a definite black deposit of mercuric sulfide was found within the balloon. This balloon was filled with hydrogen sulfide until it was tense but not stretched. (3) Cantor latex balloon that had been perfused with hydrogen sulfide for four days. This gas was passed into the balloon until it was tense. (4) Cantor neoprene balloon containing beads. This balloon had been perfused with hy-

drogen sulfide for four days. The balloon was now filled with hydrogen sulfide until it was tense. (5) Cantor neoprene balloon which had never been used was now filled with hydrogen sulfide until it was tense. (6) Cantor latex balloon which had never been used was now filled with hydrogen sulfide until it was tense. (7) Harris balloon which had never been used was filled with hydrogen sulfide until it was tense. (8) Balloon of Harris tube filled with air expired from the lungs until it was tense. This was a new balloon. (9) Cantor neoprene balloon was filled with air expired from the lungs.

Results. Balloon 1 was completely empty of gas in twenty-two minutes; balloon 2 was completely empty in twenty-two minutes; balloon 3 had lost only 50 per cent of its gas in thirty minutes. At the end of ninety minutes it had lost 75 per cent of its gas; balloon 4 had lost less than 10 per cent of its gas in sixty minutes; balloon 5 had lost less than 10 per cent of its gas in sixty minutes. At the end of two hours it had lost 50 per cent of its gas; balloon 6 had lost 10 per cent of its gas at the end of sixty minutes and 80 per cent at the end of two hours; balloon 7 had lost 75 per cent of its gas at the end of twenty-two minutes, at the end of twenty-nine minutes the balloon was empty; balloon 8 showed no change at the end of twenty-five minutes; at the end of ninety minutes there also was no change; at the end of twenty-four hours there was very slight if any change; balloon 9 showed no change at the end of twenty-five minutes, ninety minutes and twenty-four hours, respectively.

Comment. From this experiment it is readily evident that latex balloons are very highly permeable to hydrogen sulfide. Perfusion of rubber balloons for four days prior to the test does not appear to change the degree of permeability of the balloon to any appreciable extent. Neoprene G balloons proved to be far less permeable to hydrogen sulfide than were latex rubber balloons. Mercury-containing latex balloons react with hydrogen sulfide, chemically forming a sulphide of the mercury. This does not appear to change the degree of permeability of the balloon, however. Balloons filled with air retain the air for some time; the outward diffusion of the nitrogen to the air is very slow.

Experiment 4B. Forty-eight hours after Experiment 4A the balloons were again examined and the following observations made: Balloon 3 was found to be half full of air; balloon 4 contained one-seventh of its capacity of air; balloon 5 contained one-tenth of its capacity of air; balloon 6 contained one-fifth of its capacity of air; balloon 7 was empty; balloon 8 showed very slight if any change; and balloon 9 showed slight if any change.

Comment. Balloons 3, 4, 5 and 6 are those which had been thoroughly flushed out with hydrogen sulfide and then filled with this gas. All this gas had diffused out in the first three hours. All the balloons used in all experiments were tightly sealed, yet air had slowly diffused into these balloons which were permitted to lie on the table.

Experiment No. 5. The purpose of this experiment was to determine whether a high pressure of hydrogen sulfide for twenty-four hours would result in more gas diffusing into the collapsed sealed balloons. In this experiment four balloons were used. We began with a pressure of 190 mm. of mercury. This hydrogen sulfide pressure dropped to 111 mm. of mercury at the end of the experiment twenty-four hours later. The balloons used were: (1) Harris balloon with beads which took up 18 cc. of hydrogen sulfide; (2) Harris balloon with beads which took up 14 cc. of hydrogen sulfide; (3) Cantor latex balloon which took up 9 cc. of hydrogen sulfide; (4) Cantor neoprene balloon which took up 3 cc. of hydrogen sulfide.

Comment. From this experiment it is evident that using very high pressures of hydrogen sulfide does not appear to increase the diffusion of the gas into the balloons. It is again evident that the neoprene rubber balloons are far less permeable than the latex.

Experiment No. 6. In this experiment six balloons were used. A pressure of 60 mm. of mercury was maintained in the gas chamber which contained the empty balloons. This pressure of hydrogen sulfide was maintained for twenty-four hours.

Results. The results were as follows: Balloon (1) Harris balloon took up 100 cc. of hydrogen sulfide; (2) Harris balloon took up 110 cc. of hydrogen sulfide; (3) Cantor latex balloon took up 20 cc. of hydrogen sulfide; (4) Cantor latex balloon took up 25 cc. of hydrogen sulfide; (5) Cantor neoprene balloon took up 8 cc. of hydrogen sulfide; (6) Cantor neoprene balloon took up 10 cc. of hydrogen sulfide. At the end of this experiment after measuring the amounts of gas within the balloons, they were replaced within the pressure chamber and hydrogen sulfide was again passed into it. Twenty minutes later when the gas chamber was opened, all the balloons were found to be empty.

Comment. This experiment clearly shows the very high degree of permeability of the latex balloons as compared with the neoprene. It also demonstrates how rapidly hydrogen sulfide diffuses out the balloons.

SUMMARY

The importance of such studies is apparent when we consider that in many cases of intestinal obstruction that the percentage of hydrogen sulfide in the bowel ranges from 2 to 12 per cent and that no hydrogen sulfide is found in atmospheric air. The effect of the law of diffusion of gases is such that gases tend to diffuse from areas of high concentration to those of low concentration until equal pressures are obtained. That being the case, if a balloon of a long intestinal tube is present in a distended bowel containing any appreciable amount of hydrogen sulfide, we would expect the hydrogen sulfide to diffuse into the balloon since the balloon wall is a permeable membrane to this gas. As a result of our *in vitro* studies we can state definitely that latex balloons are very highly permeable to hydrogen sulfide gas. This gas changes the physical character of the latex rubber with which it comes into contact. In the presence of mercury within the balloon a black deposit of mercuric sulfide is formed with the balloon. This chemical reaction, however, does not appear to alter the permeability of the latex balloon. Neoprene rubber balloons are far less permeable than are the latex balloons.

Because the balloons of intestinal tubes are so highly permeable to hydrogen sulfide, this specific gas does not constitute a hazard in intubation even when found in appreciable amounts in the gastrointestinal tract. The reason for this is that with intestinal decompression and the removal of the intestinal gas (hydrogen sulfide) the hydrogen sulfide within the balloon diffuses outward in a matter of minutes.

CONCLUSIONS

1. Latex intestinal tube balloons are far more permeable to hydrogen sulfide than are neoprene rubber balloons.
2. Latex balloons are very highly permeable to hydrogen sulfide.
3. Hydrogen sulfide changes the character of the balloons. There is a loss of elasticity and a marked discoloration. If mercury is present in the balloons, mercuric sulfide is formed. This does not change the degree of permeability of the balloon.
4. Perfusion of the balloons with hydrogen sulfide does not appear to change the permeability of the balloons.
5. Because of its high degree of permeability and the speed of its outward diffusion, hydrogen sulfide does not constitute a hazard in intubation.

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THE TRAUMATIC CONDITION OF THE ABDOMEN*

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INJURIES to the intra-abdominal organs are not uncommon and usually are serious. Their successful management depends on early, accurate diagnosis followed by immediate intelligent treatment. An understanding of the anatomy of the abdominal area, the mechanism of injury and a thorough routine of examination are essential in caring for the patient who has sustained trauma to the abdomen.

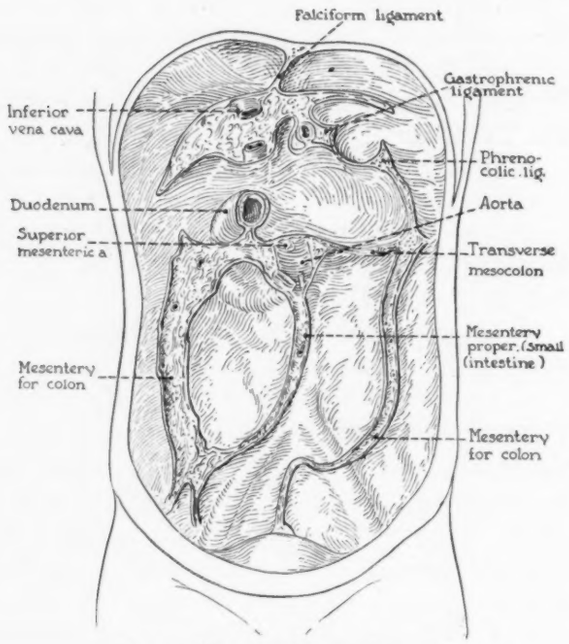

FIG. 1. Mesenteric attachments.

Anatomy. The abdominal area consists of the abdominal walls supported by the ribs and spine, anchored to the bony framework at the lower portion which is the pelvis. Within the abdominal area are the hollow organs, such as the stomach, small and large intestines, gallbladder, bile ducts, urinary bladder and urethra. The solid organs are the liver, spleen, kidneys, suprarenals and pancreas. These organs are supported by the mesenteries and accompanying blood vessels. (Fig. 1.) It is noteworthy that the mesenteric attachments are rather weak and elastic and the blood vessels are subject to injury resulting in fatal hemorrhage.

A transverse section of the abdomen at the level of the first lumbar vertebra shows that this more-or-less centrally located abdominal area contains a part of practically all the abdominal viscera except the lower intestine and urinary bladder. (Fig. 2.) Trauma to the abdomen at this level could easily injure any one of these important organs.

The various openings, such as the internal inguinal rings and the openings through the diaphragm, are possible points of trouble due to herniations of the abdominal contents. However, in the author's experience no hernias have occurred as the result of a single injury.

The solid organs have a more-or-less constant size and shape and undergo but little variation with changes in the physiologic status of the individual. The spleen becomes engorged and full after the ingestion of a meal. The other solid organs vary but little in size.

The hollow organs vary considerably in their size and shape during the normal daily activities. After a meal the stomach will increase greatly in size as will the small bowel when food enters the lumen. The urinary bladder will vary in size. Distended organs are more liable to injury than when empty; consequently, abdominal injuries are more likely to produce damage

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to the hollow viscera when sustained soon after the ingestion of food.

Mechanism of Injury. The most common causes of abdominal trauma are as follows: (1) Direct violence, such as a blow to the abdomen by some blunt object as a piece of wood or a tool that the individual may be handling. (2) Indirect violence as a fall from a height of a few feet or more, the impact of landing producing the injury. (3) Non-penetrating wounds, for example, squeezing injuries from being caught between moving objects. (4) Penetrating wounds such as from a stab or gunshot.

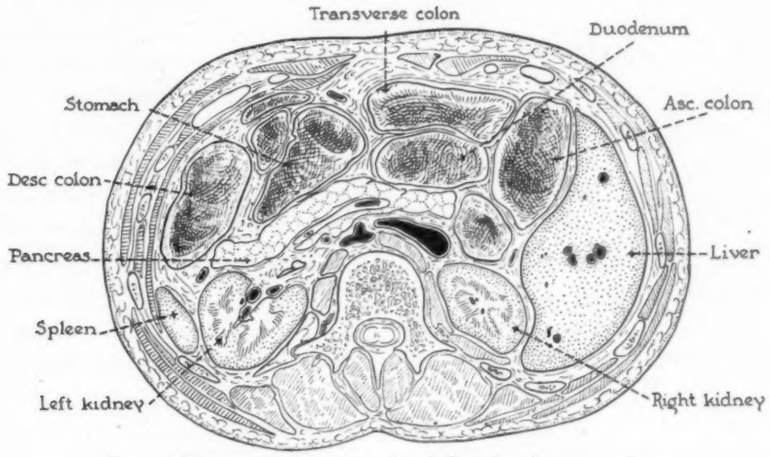

Fig. 2. Transverse section, level first lumbar vertebra.

EXAMINATION OF THE PATIENT

Success in managing cases of traumatic injuries to the abdomen may well depend on the primary examination of the patient and the recorded findings by the first attending physician. A thorough examination routine is helpful and should be combined with taking of an accurate history concerning the injury.

An accurate history and description of the mechanism of the accident should be obtained to determine amount of violence, distance of the fall or any other factors that may be of value in determining the possible severity of the injury. (Fig. 3.) The patient's reaction immediately following the accident should be ascertained—whether he noticed a sudden, sharp pain, whether he had to sit down or stop work for a short period of time or whether loss of consciousness occurred immediately. Did the patient vomit and, if so, was blood present in the vomitus? Does the patient remember the details of the accident? This information may have important bearing in helping to determine the extent of injury and in arriving at a diagnosis. In addition it may be valuable for future reference as stories of accidents frequently change after time has elapsed.

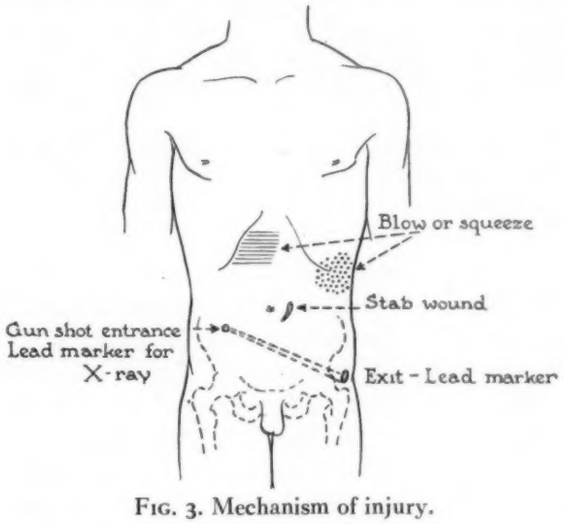

Fig. 3. Mechanism of injury.

When the patient is first seen, particular attention should be given and a record made of the degree of shock, volume and rate of the pulse, blood pressure, temperature and respirations. (Fig. 4.) The blood

count and urinalysis should be made. This gives the physician a base line concerning the status of the blood so that changes may be noted on frequent repeated counts. The presence or absence of blood in the urine is to be noted. It may be necessary to catheterize the patient to obtain a specimen.

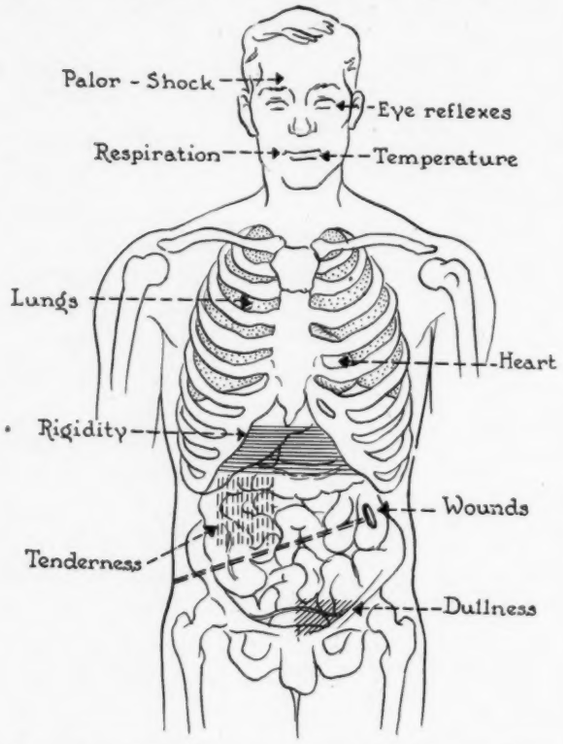

Fig. 4. Examination of patient: blood count, urine, blood pressure, record findings frequently; at least every thirty minutes mark areas of pain and dullness on the skin.

On physical examination careful inspection should be made to notice any external evidence of injury such as swelling, abrasions, areas of redness or open wounds. Clinical evidence of fractures about the pelvis, spine or ribs should be noted. Palpation of the abdomen will determine if there are any local points of tenderness or muscular resistance. Areas of dullness or tympany will be discovered by percussion. It is well to mark off such regions with ink. Thus any shifting of these areas may be determined and easily checked at repeated examinations. Bleeding from the orifices of the body such as the urethra and rectum give clues to likely sites of injury. This indicates careful digital examination of the rectum and, in the case of a female, bimanual pelvic examination.

Radiograms showing the entire abdomen, including the pelvis and lower chest, should be taken. This survey will rule out or determine fractures of the pelvis, ribs and lower vertebrae. The anteroposterior and lateral views are used, the latter being helpful in determining the presence of free air in the abdominal cavity. Opaque foreign bodies are discovered by x-ray. To facilitate x-ray interpretation lead markers placed on the skin of the patient can be used to indicate wounds, points of entrance and exit of missiles and localized areas of pain as pointed out by the patient.

If after a careful history, physical and special examinations the extent of injury is not evident, the patient should be put to bed for observation. Repeated examinations should be made at least every thirty to sixty minutes until a positive diagnosis is reached. It is advisable to avoid, if possible, sedative drugs such as morphine during the period of observation as they tend to mask important symptoms.

The surgeon should attempt to make a positive diagnosis of intra-abdominal injury within six hours from the time of accident, preferably within two to four hours. A patient operated upon within six hours, as a rule, has a good chance for recovery; after six hours his chance of recovery greatly diminishes.

MANAGEMENT AND TREATMENT

When shock is present, it should be treated promptly by elevating the foot of the bed, with general supportive measures of intravenous fluids, plasma or blood as indicated. Oxygen by nasal tube is efficacious. Use of hot water bottles, electric pads or other sources of heat should not be used as they dilate surface capillaries, tend to produce loss of body fluids, lower blood pressure and increase oxygen needs of the body.

In perforating wounds of the abdomen, such as gunshot or stab wounds, it is apparent that the abdominal wall has been

pierced so that immediate operation to repair the defects should be performed. This type of injury is usually evident and need cause no delay in diagnosis and deciding the treatment.

In selecting an anesthetic preference is given to nitrous oxide, cyclopropane or ethylene, preceded by one or two injections of morphinescopolamine depending on the available time before the operation is begun. We have found the use of intravenous curare (intocostrin) materially aids in providing desirable relaxation of the abdominal musculature when given before and during inhalation anesthesia.

Use of penicillin and sulfa drugs is a valuable adjunct to the surgical management of intra-abdominal injuries. The peritoneum itself has remarkable powers of combating infection. This power is enhanced by removal of sources of infection and by closure of all perforations in the hollow viscera. Infection *per se* is a less frequent cause of death than shock or hemorrhage.

Intact skin is no guarantee that an intra-abdominal injury is not present, and both hollow and solid organs may be injured by local or diffuse non-penetrating force. The decision to explore an abdomen following non-penetrating trauma is a more difficult one than the clear cut obligation in penetrating wounds. This decision will depend on the general appearance of the patient, pulse, blood pressure, abdominal signs and laboratory findings. The history of trauma followed by early localized abdominal pain becoming generalized suggests leakage. A ruptured hollow viscus causes immediate peritoneal irritation, with a resultant pale, drawn face and apprehensive expression. Additional signs are pain aggravated by motion, vomiting, rapid costal breathing, abdominal tenderness, rigidity and tympanities. Immediate exploratory laparotomy is indicated with severe persistent pain, i.e., continuous or intermittent, localized or general associated with vomiting or retching, diffuse tenderness and muscle spasm with or without signs of hemorrhage.

The choice of incision depends on the tentative diagnosis as to which organ is suspected of injury. The upper abdomen may be approached either through the high midline, right or left rectus or transverse incisions. The lower abdomen may well be reached through a midline, right or left rectus or paramedian incision. There are many advocates of the transverse incision. The abilities and habits of the surgeon will influence the type of incision used. Injuries to the solid organs will usually result in hemorrhage and on opening the peritoneum free blood will be found. A systematic exploration is carried out starting at a fixed point. The viscera are examined for lacerations and bleeding points and the mesentery is inspected. Care in handling the tissues is important. The injury is located and treated as indicated.

Closure of the abdomen following exploration and repair of the damaged tissues is preceded by a final toilet of the peritoneal cavity by aspiration and sponging. Use of the sulfonamide compounds in the peritoneal cavity is a valuable adjunct to surgical treatment. The closure is carried out by use of interrupted figure of eight chromic catgut sutures. Drainage depends on the situation and judgment of the surgeon. Drainage of wounds is indicated in the presence of bile in the abdomen and pancreatic wounds.

Liver. The liver by its large size, fixation, friability and slight elasticity is predisposed to lacerations. (Fig. 5.) Injuries to the gallbladder and cystic and common ducts may accompany liver trauma.

The clinical picture will depend on the extent of parenchymal and vascular damage. It will vary from slight distress in the right hypochondrium to profound shock. Peritoneal irritation due to bile and blood may refer pain to the right scapular region. X-ray study may reveal elevation and immobilization of the right half of the diaphragm.

Penetrating wounds may be clean cut lacerations, fragmented wounds with single penetrations which can tear an entire

lobe. Non-penetrating trauma, such as squeezing or falling injuries, can result in rupture of the capsule and liver parenchyma and central rupture. Injuries to the liver may be treated conservatively if one can be reasonably sure that the patient is not developing a serious hemorrhage. With evidence of internal hemorrhage, it is essential to open the abdomen and control the source of bleeding. Injuries to the liver can best be managed by resorting to suturing, simple gauze pack or omental or muscle grafts. The use of a gelatin sponge with thrombin is proving a very valuable aid in this type of wound.

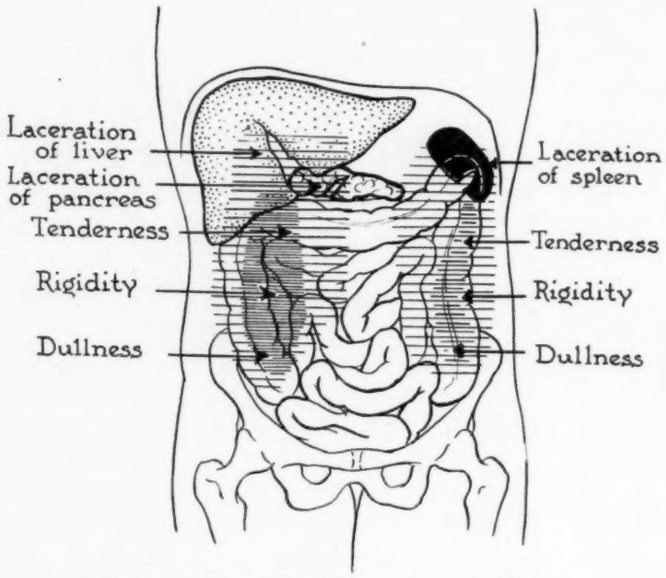

FIG. 5. Injury to liver, pancreas and spleen.

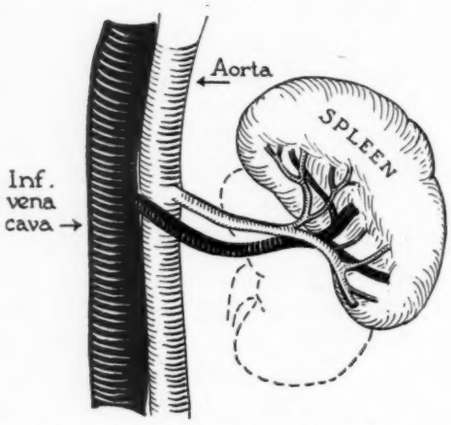

FIG. 6. Blood supply of the spleen.

Gallbladder and Common Duct. Gallbladder tears may require cholecystostomy or removal of this organ. Injuries to the common bile duct, although rare, may be found and require repair over a T-tube or anastomosis to the gallbladder, duodenum or stomach.

Spleen. The spleen is injured by penetrating wounds or by blunt trauma including fractured ribs. (Fig. 6.) The spleen is mobile, lacks elastic tissue and is protected to some extent by the left thoracic cage. Lesions vary from small fissure-like tears to extensive lacerations with separation at the pedicle. Hemorrhage is the main clinical feature associated with pain, tenderness, rigidity and left shoulder pain.

X-ray study may reveal immobile or elevated left diaphragm. There is an increase in the area of splenic dullness and gastric tympany may be obliterated. Splenic injuries show two clinical pictures: one of immediate hemorrhage and subsequent signs of shock from hemorrhage and second, that of delayed hemorrhage with a latent period of a few hours to several weeks. Repair of the spleen is almost never attempted. The spleen can be removed without subsequent ill effects. Care must be taken not to injure the pancreas or the stomach during removal of the spleen.

Pancreas. The pancreas is situated in the lesser peritoneal sac, rests on the vertebral column and is well protected. Injuries caused by direct penetration, blows to the epigastric region or by crushing the pancreas against the vertebral column are seen. There may be lacerations of the head, body or tail or simple contusion to the pancreas. Clinically, shock is usually severe with excruciating pain in the epigastrium. A mass may form above the umbilicus. Use of the blood serum amylase test is helpful when doubt exists concerning pancreatic injuries. An elevation of the

serum amylase value is indicative of injury to the pancreas.

The pancreas is exposed through the opening of the lesser or gastrocolic omentum. Lacerations of the pancreas are repaired with non-absorbable sutures. Any devitalized tissue is removed and divided ducts, if not reparable, are ligated. Soft rubber tissue drains are placed down to the injured pancreas. Cysts which may form from hemorrhage into the substance or into the lesser peritoneal cavity are incised, emptied and marsupialized.

Kidney. Injuries to the kidneys are fairly common complications of abdominal trauma. (Fig. 7.) The hilum and large vessels if injured may result in necrosis of the kidney with resultant infection as the renal arteries are terminal. If the kidney pelvis is damaged, leakage of urine into the retroperitoneal tissues or peritoneal cavity results. Parenchymal perforations, lacerations or bisection of the kidney, injury to perirenal tissue with hemorrhage and subsequent infection are problems seen in kidney injuries.

Hematuria, the most prominent symptoms in renal injuries, is usually present from the onset and may persist for one to two weeks. Associated with hematuria is pain in the back which may increase in severity so as to require sedatives. A moderate degree of shock is present and may result in anuria. Reflex peritoneal irritation may be manifested by adynamic ileus and abdominal rigidity.

X-ray studies may demonstrate a foreign body and evidence of renal injury, such as change in size and contour of the kidney and absence of the psoas muscle outline. Intravenous urography may be helpful. Retrograde pyelographic study may be dangerous and make immediate surgery imperative. The firm capsule of the kidney will control hemorrhage except in extensive tears.

If the patient's general condition progresses, satisfactorily, conservative and supportative management is indicated although the use of drainage in the loin may be necessary later. If the patient's condition appears critical, it may be necessary to explore the kidney area to control hemorrhage and institute drainage. In some cases prompt nephrectomy is indicated.

Stomach. The stomach by its large size and relatively exposed anatomic position in the abdomen is subject to injury either from penetrating wounds or from blunt trauma to the upper abdominal wall. (Fig. 8.) The injuries may vary from simple perforations to jagged tears and may include one or both walls. The rich blood supply to the stomach allows for possible severe hemorrhage.

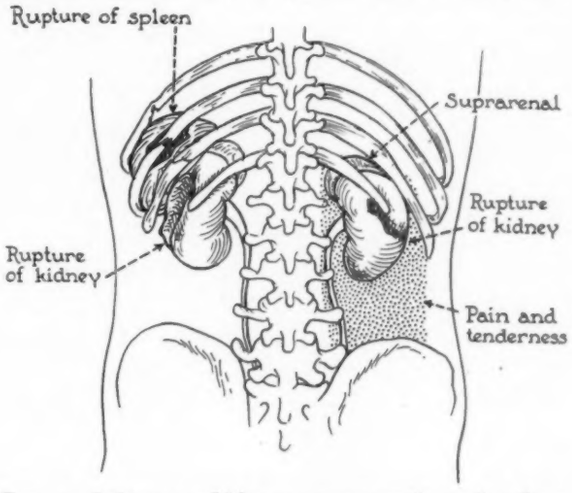

Fig. 7. Injury to kidneys, suprarenals and spleen.

Clinically, the patient may complain of severe epigastric pain of a localized or diffuse type. Muscular rigidity is usually "board-like" but may vary to a lesser degree. X-ray studies may reveal free gas in the peritoneal cavity usually located just below the diaphragm.

Management calls for immediate operative intervention with exposure of the stomach usually through a midline or left rectus incision. Adequate exposure of the stomach and thorough examination, including the posterior wall, is necessary. Enlargement of anterior perforations to expose the posterior wall is permissible when indicated. Perforations and tears are closed in layers after débridement, using layers of chromic catgut, the last row being the Lembert type of suture. Only rarely is

gastro-enterostomy or gastric resection indicated. Decompression by means of the Levine tube and Wangensteen suction is used for the first twenty-four to seventy-two hours postoperatively. Intravenous fluids may be employed to maintain proper nutrition and fluid balance of the patient.

Exteriorization of the injured segment and enterostomy may be necessary in isolated cases. In duodenal injuries exploration of the anterior and posterior surfaces is required. The posterior surface will call for mobilization by means of lateral incisions along the anterior border

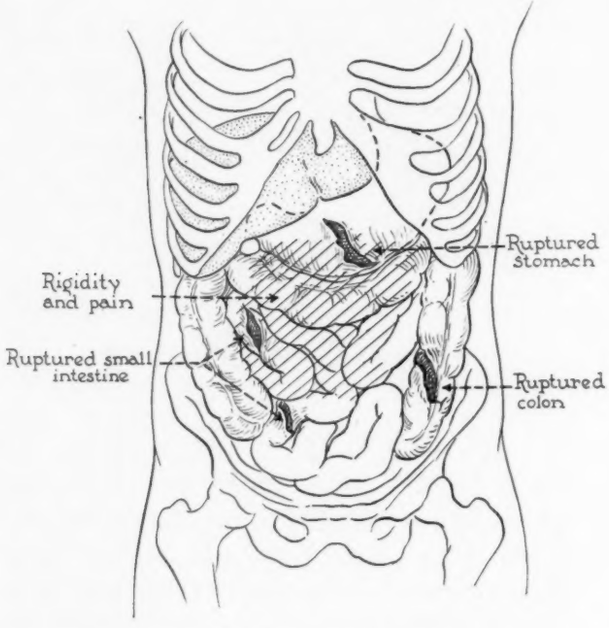

Fig. 8. Injury to stomach and intestines.

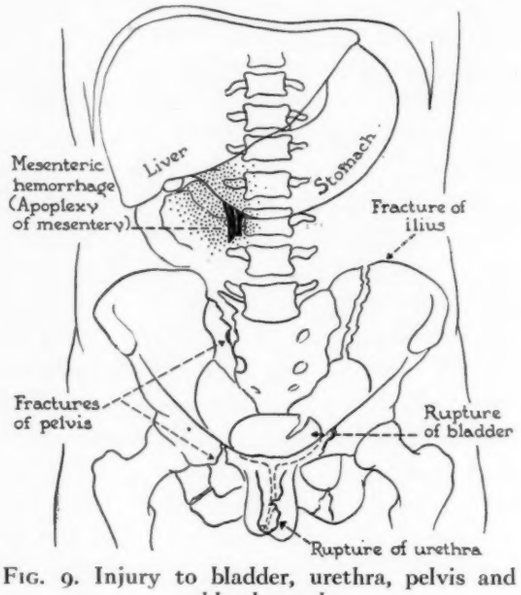

Fig. 9. Injury to bladder, urethra, pelvis and blood vessels.

Small Intestine. The close proximity of the intestinal coils and the anatomic features makes the small intestine vulnerable to multiple perforations and tears. The duodenum being in a fixed position may be crushed against the vertebral column. The ileocecal and duodenojejunal junction are possible sites of rupture. The clinical signs are those of peritoneal irritation. These signs may be delayed until bowel activity is later stimulated. X-ray may reveal free gas in the peritoneal cavity and in case of duodenal injuries may reveal gas about the retroperitoneal tissues.

Simple perforations are closed in the transverse axis using self-inverting Connell suture supplemented by a Lembert suture. Larger tears may require lateral or end-to-end anastomosis or resection when large segments of bowel are destroyed.

of the duodenum and mesial retraction to expose its fixed retroperitoneal surface. Single perforations are closed. If the duodenal lumen is narrowed, a gastro-enterostomy is indicated. Larger or complete tears may require partial gastrectomy with closure of the duodenum.

Large Intestine and Rectum. Any section of the large intestine and rectum may be injured by perforating wounds. The cecum, hepatic and splenic flexures may be ruptured by non-penetrating trauma. Wounds may vary from isolated contused areas to large perforations and ragged tears. Due to the anatomic features of the large intestine, extreme care must be used in management of the large bowel injuries. The blood supply of the large bowel is specifically from three major sources: the superior mesenteric, the inferior mesenteric

and the internal iliac branches. The adequacy of blood supply to the remaining bowel is important in resecting injured segments. A large portion of the colon is retroperitoneal. Colon injuries in the retroperitoneal location may be easily overlooked and lead to severe infection of the connective tissue planes and muscles of the posterolateral abdominal wall. If proper primary care is not given to this type of injury, these infections may lead to a fatal outcome.

The rectum may be injured in associated wounds of the buttock, pelvis, flank and thigh. Compressed air injuries to the rectum are on record.

Treatment of large bowel injuries varies from the simple suture with omental graft to resection or exteriorization and colostomy proximal to the site of injury. Mobilization of the colon for retroperitoneal perforations may be necessary. Rectal injuries with suspicion of peritoneal involvement indicates immediate laparotomy.

Management of rectal wounds requires débridement of the original external wound, repair of the rectal defect, with drainage of retrorectal space and colostomy if indicated. Colostomy is to be considered in management of all rectal wounds.

Mesentery and Blood Vessels. A tear in the mesenteries of the bowel would give the picture of hemorrhage and indicate exploration and repair of the defect. Resections of the triangular area with accompanying devitalized bowel may be necessary. Retroperitoneal hemorrhage is treated conservatively and only when the clinical picture indicates increasing hemorrhage is operative intervention carried out. Infection of hematomas requires drainage.

Trauma to the large vessels of the abdomen such as the aorta or vena cava may cause profuse hemorrhage and require rapid treatment. The use of suture, and recently the gelatin sponge, will close these defects if operative treatment can be carried out before the patient becomes exsanguinated.

Pelvic fractures are included here because of the frequency with which the intra-abdominal organs may be injured by pelvic bone fragments. The rectum, urinary bladder and urethra are the organs most commonly involved. In pelvic fractures the attending physician must be alert to the possibility of an accompanying injury to vital soft parts.

Urinary Bladder and Urethra. The urinary bladder may be injured by penetrating wounds, nonpenetrating trauma to lower abdomen or by associated pelvic fracture. (Fig. 9.) The wounds may vary from a small puncture type to an extensive laceration. Wounds of the dome and posterior wall of the bladder are intraperitoneal, those involving the anterior, lateral walls and base of the bladder are extraperitoneal. The intraperitoneal type may also involve the small intestine and pelvic colon. Extraperitoneal wounds are followed by urinary infiltration, destructive cellulitis and widespread necrosis unless proper drainage is promptly carried out. Local pain results from urinary extravasation. Blood may be present in the urine. A full bladder suggests absence of leakage while an empty bladder indicates an intraperitoneal extravasation.

Treatment of the urinary bladder wounds is carried out by débridement, repair of the laceration and proper drainage of tissue spaces of the pelvis. Suprapubic cystotomy is indicated.

The urethra is injured by similar mechanisms as the urinary bladder or by falling astride a firm object. Lacerations of the posterior urethra may necessitate repair to restore continuity to its lumen for when it is completely severed, the ends tend to retract which makes it impossible to pass a catheter or urethral sound. (Fig. 10.)

The perineal approach to repair the urethra has been commonly employed which requires considerable dissection and is frequently very difficult. A simpler method, which was first described by Dr. George G. Davis of Chicago and later popularized by Dr. Vincent J. O'Conor of

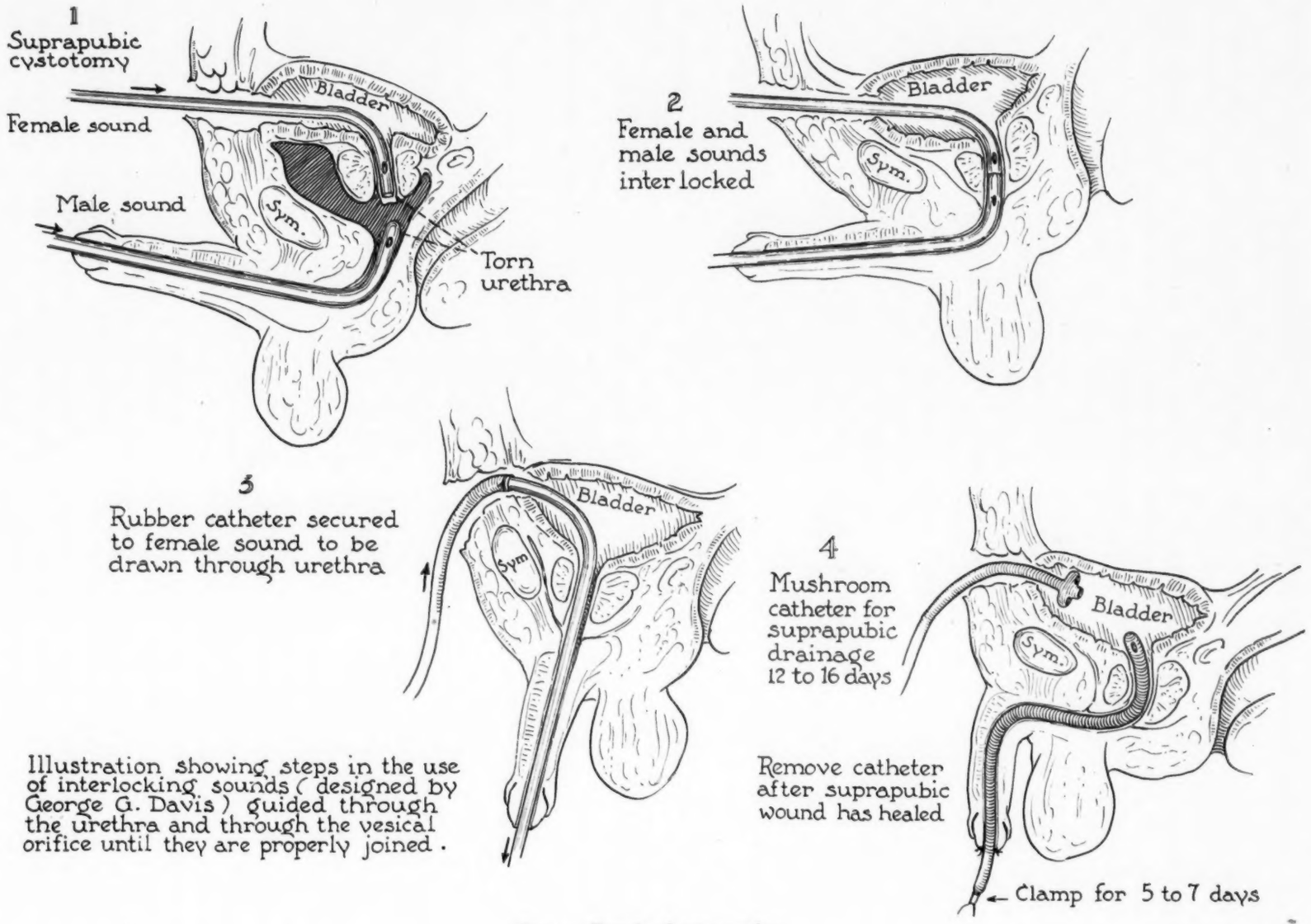
1
Suprapubic cystotomy
Bladder
Female sound
Male sound
Sym.
Torn urethra
2
Female and male sounds inter locked
Bladder
Sym.
3
Rubber catheter secured to female sound to be drawn through urethra
Bladder
Sym
4
Mushroom catheter for suprapubic drainage 12 to 16 days
Bladder
Sym.
Remove catheter after suprapubic wound has healed
Clamp for 5 to 7 days
Illustration showing steps in the use of interlocking sounds (designed by George G. Davis) guided through the urethra and through the vesical orifice until they are properly joined .

FIG. 10. Repair of torn urethra.

Chicago, consists in doing an extraperitoneal suprapubic cystotomy with retrograde splinting of the urethra by indwelling catheter. Perineal incision is used only when necessary to drain extravasated blood and urine.

As shown from the schematic drawings, interlocking sounds are passed simultaneously through the posterior urethra and anterior urethra and joined in such a way that the urethra introduced member (male sound) may be fitted snugly into the second passed through the bladder neck (female sound) thus permitting the former to be guided safely into the bladder. A No. 22 soft rubber catheter is then stitched securely over the end of the male sound and the edges of the catheter are tied tightly to approximate the taper of the sound thus facilitating the ease of drawing the catheter back through the urethra and assuring a smooth passage through the friable ruptured portion.

When the catheter has been placed in the urethra in its proper position, it is sutured to the meatus on the underside so that it remains in position for about twelve to sixteen days. The bladder is closed in the usual manner with a mushroom catheter in the dome for immediate drainage. The urethral catheter is closed for five to seven days and then opened. The bladder is irrigated and the suprapubic catheter is removed in about twelve to sixteen days.

The urethral catheter is removed when the suprapubic wound seems firmly healed, usually by the sixteenth day after operation. This method as a rule gives complete restoration of normal urinary function with subsequent lack of urethral stricture as compared with the results obtained in a patient operated upon by the perineal route. The patients may later require an occasional urethral dilatation.

CONCLUSIONS

It is important in any history of injury or violence about the abdominal area that the patient be given a thorough and careful examination at once to determine the extent of injury. Special attention should be directed toward obtaining an accurate account of the mechanism of injury, a careful physical examination, recording of findings and prompt laboratory and x-ray examinations. Frequent observations should be made to observe the progress of symptoms and physical findings so as to give prompt surgical treatment when indicated.

Patients operated upon within the first six hour's after a severe injury have better chances of recovery than those patients in whom surgery is delayed beyond the six-hour period. In case of doubt it is safer to explore the abdomen than to delay surgery too long as it may jeopardize the life of the patient.

EXPERIENCE WITH THE NORTON EXTRAPERITONEAL SECTIONS*

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EXPERIENCE at the University of Maryland with any type of extraperitoneal section prior to 1947 was very scant. One Latzko section had been done in 1926 and one was done ten years later. In 1942 two of the Waters type of extraperitoneal section were done, two in 1943 and, again, one in 1946. In 1947 the junior author assisted in two more of the Waters type of extraperitoneal operation and was impressed with one thing, namely, that the operation was technically difficult, at least to the occasional operator. He believed and still believes that there is a definite place in the armamentarium of the obstetrician for the extraperitoneal section and in an effort to discover the relative merits of the two leading types, the Waters and the Norton, a visit was made to the Margaret Hague Maternity Hospital in February, 1947. There it appeared to the observer and was gathered from general conversation that the Norton was the easier operation. It required less sharp dissection and offered fewer blind fascial tunnels which eventually led either into the bladder or into the peritoneum; this happened all too often in our brief experience with the Waters section.

Since it was desired to gain as much experience with the Norton section as possible and since it was believed that no harm would result to the patient in the elective cases even if the peritoneal cavity was entered, the operation was extended to include those cases which did not actually meet the general requirements for an extraperitoneal section. Twenty-three cases were thus accumulated in a little less than a year for the period ending March 1, 1948.

Norton says cases may be divided into those: "(1) potentially infected and (2) frankly infected. . . . The potentially infected . . . any patient in labor for a period of eight (8) hours or more with ruptured membranes for a similar duration of time, is potentially infected in the sense that pathogenic micro-organisms have gained access to the amniotic sac; the longer and further this type of labor progresses, the more likely the patient is to be frankly infected."[1]

The University of Maryland Obstetrical Clinic has followed further along in this interpretation of infection in labor. The patient is potentially infected if she has been in labor for eight hours or more with or without ruptured membranes. The important consideration is that the patient is infected. Whether this infection is potential or frank is not too important except in severely infected patients. Norton warned about this type of case when he reported two maternal deaths due to overwhelming infection in a series of 163 cases of paravesical extraperitoneal section. One case was associated with severance of the left ureter and injury to the bladder and the other was associated with peritonitis following entry into the peritoneal cavity after sixty hours, with ruptured membranes and fifty-five hours of hard labor. These deaths occurred in 1935 and 1936, prior to the days of chemotherapy and antibiotics, and represented two of three maternal deaths in this whole series; the third death was due to postoperative hemorrhage from an atonic uterus. Our experience in this particular series with the very badly infected patient is nil. We

* From the University of Maryland Hospital, Baltimore, Md. Read before The Travel Club, Virginia Obstetrical and Gynecological Society, April 21, 1948.

believe that cesarean hysterectomy, as advocated by Dieckmann and others, might be indicated in those very severely infected, although extraperitoneal section properly performed plus chemotherapy and antibiotics should handle the majority of these cases.

Twenty-three cases of the Norton type of paravesical extraperitoneal section are presented and indications for section are tabulated. (Table 1.) They are further subdivided into those cases which meet the requirements just mentioned for extraperitoneal section and those cases in which the extraperitoneal approach was optional.

Table I

Indication for Section	No. of Cases	Extraperitoneal	
		Indicated	Not Indicated
Disproportion, cephalopelvic	11	7	4
Dystocia, positional, occiput posterior with borderline disproportion, cephalopelvic	3	3	0
Presentation of funis	1	0	1
Section previous for disproportion, cephalopelvic	3	1	2
Stricture, rectal	1	1	0
Pre-eclampsia, severe	2	0	2
Tuberculosis, bilateral, hip, chronic	1	0	1
Presentation mentum transverse in elderly primigravida	1	0	1
Total	23	12	11
Percentage	100	52.17	47.83

One case (E. J.) was particularly controversial. The patient, a twenty-three year old unregistered colored primigravida, was admitted to the hospital at 12:30 A.M. on August 19, 1947, after approximately forty-nine hours and thirty minutes of labor at home under the supervision of first a midwife and then a local physician. Upon admission rectal findings were inconclusive except that the patient had a very large baby estimated to be about 4,500 Gm. A sterile pelvic examination revealed the cervix to be thick, boggy and 4 to 5 cm, dilated, the presenting part in the left occiput posterior position, the head unengaged, 2 plus caput formation and considerable overlapping of the cranial bones. The fetal heart was not definitely heard although at the time of admission one observer thought it could be heard in the left lower quadrant. The membranes were ruptured at the time of the sterile pelvic examination. The patient was on penicillin therapy and was kept well hydrated with intravenous fluids. A cephalopelvimetry was interpreted as a small gynecoid pelvis with marked cephalopelvic disproportion, the baby in the left occiput posterior position with mild extension of the head. There was marked molding and overlapping of the cranial bones. The fetal heart could not be heard later in the day even by the observer who had first believed it was present. The patient's general condition remained good. Temperature twelve hours after admission was 100°F., pulse 130 and respirations 22. The patient continued in labor. About 4 P.M. the cervix was 7 to 8 cm. dilated, the presenting part was still unengaged and the baby was probably dead. The mode of delivery was then the problem. Should the patient be delivered from below by craniotomy? Would the prolonged labor of over sixty-five hours by this time so have thinned out the lower uterine segment that intra-uterine manipulation might possibly rupture the uterus and thus spill the frankly infected contents into the peritoneal cavity? Would it not be better in this case, even with the realization that the baby was probably dead, to perform an extraperitoneal section? The consultant and the resident believed that the latter was the procedure of choice although there was some disagreement from other sources, and the patient was delivered of a full term, dead, male child weighing 5,415 Gm. from the left occiput posterior position at 8:21 P.M., March 19, 1947, by Norton extraperitoneal section. The third stage of labor was normal; total labor was sixty-nine hours and twenty-one minutes. The fetus was found to be slightly macerated, the lower

uterine segment was paper thin and it was necessary to perform a craniotomy and a bilateral cleidotomy in order to deliver the baby. There was no extension of the uterine incision and the peritoneal cavity was not opened. There was no injury to the bladder. The large size of the baby was suspicious of maternal diabetes mellitus and subsequent work-up confirmed this diagnosis. The patient's postoperative course was afebrile on penicillin and sulfadiazine therapy. Sutures were removed on the eighth day and the wound was well healed with no evidence of infection. She was allowed up on her tenth day and was discharged in good condition on her fifteenth postoperative day.

TECHNIC

The general technic for this operation follows that outlined by Norton, except for several minor points: Anesthesia is usually spinal, most of these operations being done with 20 mg. of pontocaine with 2 cc. of 10 per cent dextrose. A Foley catheter is inserted into the bladder and connected to a bladder irrigation bottle containing a colored solution, usually indigo carmine or methylene blue. Abdominal preparation is carried out and patient is draped per routine. A left paramedian incision is made from a point approximately 6 cm. below the umbilicus down to the symphysis pubis. The anterior rectus sheath is exposed and incised. The left rectus muscle is then separated by blunt dissection from the underlying transversalis fascia while the bladder is distended with approximately 200 cc. of colored solution. The left rectus muscle is then lifted upward and retracted laterally. An area of yellow "chicken fat" is then identified at the left superior lateral surface of the bladder (the left paravesical space). The index finger of each hand is inserted into the region of the yellow "chicken fat" and by blunt dissection the transversalis fascia and the anterior sheath of paravesical fascia is lifted from the bladder wall. The left lateral portion of the bladder may then be "popped out" of its fascial envelope as though one were peeling a grape. The fascial layers over the anterior surface of the bladder are then incised in a downward direction (toward the right lower quadrant of the bladder) in order to avoid injury to the anterior peritoneal fold. The bladder is partially emptied and the lower uterine segment on the left is then exposed by stripping the left superior lateral wall downward and thus exposing a triangular space formed by the posterior peritoneal fold, the partially removed bladder and the left rectus muscle. The fascia overlying the lower uterine segment in this triangular space is then incised. This fascia is the posterior sheath of the paravesical fascia and the anterior sheath of the periuterine fascia. It is thought that the use of an assistant's hands instead of abdominal retractors will lessen the incidence of perforation of the peritoneal fold or trauma to the bladder. The posterior peritoneal fold is retracted upward, the bladder downward to the right lower quadrant of the pelvis and the fascia laterally to the left. Incision in the uterus may be either longitudinal or transverse. All incisions should be made under direct observation. The infant in the vertex presentation is delivered by manual rotation to the occiput posterior position and application of low Simpson forceps. One ampule of pitocin is given intravenously after delivery of the baby. The placenta is removed manually if it does not spontaneously deliver after several minutes or cannot be expressed by gentle Credé. One ampule of ergotate is then given intramuscularly after delivery of the placenta. Sponge forceps or T clamps are applied to the edges of the uterine incision only after the placenta and membranes are completely expressed. The uterus is closed in two layers; the first layer is a row of interrupted sutures of No. 1 chromic catgut and the second is a continuous inverting Cushing suture of No. 1 chromic catgut. The bladder is refilled with a colored solution in order to test for possible lacerations. Two Penrose drains are inserted; one in the lower angle of the retrovesical area and the other in the left paravesical region.

The left rectus muscle is approximated in the midline to the opposite rectus muscle with interrupted sutures of 00 plain catgut. The anterior rectus sheath is closed with interrupted figure-of-eight sutures of No. 1 chromic catgut. The subcutaneous tissue is closed with interrupted sutures of 00 plain catgut and the skin with interrupted vertical mattress sutures of black silk. The Foley catheter is allowed to remain open with constant drainage for twenty-four hours and is then removed. The patient is catheterized thereafter every eight hours for residual urine until the residue is less than 50 cc. One ounce of 1:1,000 silver nitrate is instilled in the bladder every twenty-four hours during the period that residual catheterization is necessary.

The average operative time was one hour and twenty-five minutes; the shortest time was forty-six minutes and the longest time was two hours and nine minutes. Twenty-two sections were performed under spinal anesthesia, pontocaine, 20 mg. and 2 cc. of 10 per cent glucose. One section was done under cyclopropane anesthesia without any particular indication. The average fetal weight was 3,345 Gm.; the smallest baby was 2,466 Gm. and the largest, a stillborn, was 5,415 Gm. This baby was delivered by craniotomy and cleidotomy. (Case E. J.) The largest liveborn baby delivered was 4,082 Gm. (Table II.)

Postoperative morbidity is defined as a rise in temperature to 100.4°F. on any two days following the first twenty-four hours, the temperature being taken every four hours. An analysis of eight cases in which the peritoneal cavity was entered at the time of operation can be seen in Table III.

This incidence of postoperative morbidity exceeded the general postoperative morbidity for the entire twenty-three sections approximately 9 per cent.

TABLE II

NORTON EXTRA-PERITONEAL SECTION

	Average Labor in Hr.	Average Labor with Ruptured Membranes	Peritoneal Cavity Opened		Bladder Injured		Post-operative Morbidity		Stillborn or Neonatal Deaths		Babies over 3,800 Gm.		Maternal Deaths	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total cases 23	17 hr. 24 min.	6 hr. 8 min.	8	34.78	1	4.34	6	26.08	1	4.34	4	17.39	0	0
Total cases indicated 12 (52.17%)	37 hr. 8 min.	14 hr. 3 min.	3	13.05	1	4.34	2	8.69	1	4.34	3	13.05	0	0
Total cases not indicated 11 (47.83%)	1 hr. 56 min.	2 hr. 1 min.	5	21.73	0	0	4	17.39	0	0	1	4.35	0	0

TABLE III

MORBIDITY WHEN PERITONEAL CAVITY WAS ENTERED

Peritoneal Cavity Invaded	No. Cases	No. with Morbidity	Percentage
Indicated extraperitoneal section	3	1	33.33
Not indicated extraperitoneal section	5	2	40
Total	8	3	37.50

TECHNICAL DIFFICULTIES

1. Three of the twenty-three sections were cases in which a low section had been done before. There was no particular difficulty encountered in these cases although in spite of more than ordinary care to avoid entering the peritoneal cavity in two of the three cases it was entered. This is 66.66 per cent as compared to the series

incidence of 34.78 per cent. In one case in which a previous low section had been performed a Norton section was tried but the adhesions between the anterior and posterior rectus sheaths and the rectus muscle were so dense that it was impossible to find a line of cleavage. A routine low section was then done.

2. Norton recommends the use of 5 Gm. of sulfanilamide powder in the retrovesical space. This was carried out in the first ten cases and one finds little difference in comparison to the next thirteen cases in which it was not done, provided the patient is placed on penicillin and oral sulfonamides. The procedure was abandoned following one case in which a severe episode of cyanosis occurred following the use of 4 Gm. of sulfanilamide in the retrovesical space. No case of paravesical abscess, cellulitis or sinus formation occurred. There was one stitch abscess and one superficial wound breakdown, both associated with faulty operative technic.

3. A Penrose drain was used in all cases except one. This case was an elective Norton section and the patient did well without evidence of infection. There was a considerable amount of serosanguineous drainage for the first forty-eight hours following operation. It would be extremely hazardous to omit the drain, at least in the indicated cases, and not provide this material with an avenue of escape. One of the objections to the Norton extraperitoneal section is the opportunity for soft tissue infection, particularly about the bladder. Consideration must be given to this point but it must be remembered that even in the low cervical section infected lochia may escape through the uterine wound into the soft tissues about the lower uterine segment below the peritoneal flap.

4. The uterovesical fold of peritoneum must be carefully inspected for lacerations and if found these should be sutured before the uterus is opened. Peritoneal contamination is theoretically much higher if this is not done. This is also a debatable point since a hole, even the size of that made by an average-sized round needle, certainly affords an avenue of entry for bacteria into the peritoneal cavity.

5. The bladder must be distended with a colored solution such as methylene blue or indigo carmine to locate any locations.

6. One of the contraindications which might exist even in a case otherwise suited for the extraperitoneal type of section is that in which there is so much evident uterine inertia prior to delivery that it may be anticipated that the uterus will not contract properly following section. Cesarean hysterectomy would probably be indicated here.

CONCLUSION

The Norton type of paravesical extraperitoneal section offers to the obstetrician a method of abdominal delivery when the patient is infected and when there is no contraindication to the extraperitoneal approach such as (1) a very severely infected patient; (2) atonic uterus; (3) when sterilization is desired; (4) an adenxal condition such as an ovarian cyst producing dystocia.

Twenty-three case histories of patients operated upon at the University of Maryland Hospital during the past year ending March 1, 1948, following the technic of Dr. J. F. Norton of the Margaret Hague Maternity Hospital are presented. It is a simple operation and easily performed. This series, performed by many operators some of whom had very little operative experience, shows results that are neither too bad nor too good. This type of section should be done more often in order that one may honestly say "it is a good section and gives good results" or "it is a poor section and has too many dangers and complications." This clinic still does not know the answer and our results to date are presented for consideration as a step toward achieving a true picture of this operation.

REFERENCE

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RECENT DEVELOPMENTS IN WATER BALANCE*

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WITHIN the past decade the medical profession, especially the surgeon, has become particularly interested in body fluid changes associated with change in body health. We have gradually grown conscious of the fact that water and electrolyte balance influences the fundamental control mechanisms of life to no little degree. However, there are few fields in the modern armamentarium in which more general confusion exists in the mind of the average surgeon. This is chiefly because so little specific knowledge is available to aid in the establishment of principles upon which an objective choice of parenteral fluid agents might be made.

To date very little has been done to keep the general surgeon, not versed in intricate physiology, up to date on the modern concepts of fluid balance in terms applicable to the clinical patient seen in private practice. As a result the administration of parenteral fluids is carried out haphazardly by rule of thumb based on principles that have been found erroneous by their original proposers and long since discarded. This fact is responsible for the gross abuse of fluid administration particularly in the small general hospital.

For full understanding of the term water balance a few definitions and a few fundamental concepts must be considered: The first of these is the term extracellular fluid. (Fig. 1.) Extracellular fluid is composed of the plasma of the blood and the interstitial fluid (including lymph) which lies between the vascular compartment and the tissue cells. Functionally considered extracellular fluid is a particularly clear cut entity. Its physiologic rôle is as evident as that of the nervous system. Extracellular fluid constitutes the immediate environment of the organism. It replaces, and in its essential features still closely resembles, the external environment (sea water) of the early forms of life. This

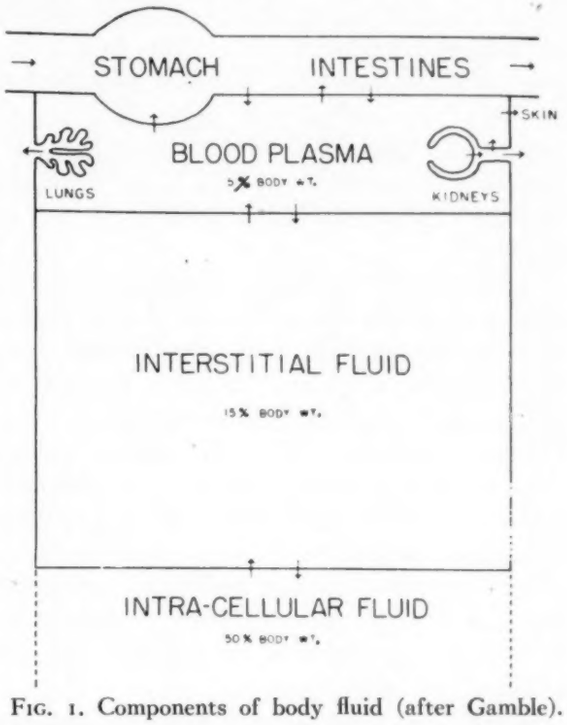

FIG. 1. Components of body fluid (after Gamble).

aqueous medium which surrounds the tissue cells is the vehicle of transport of nutrient and waste materials. Beside this simple service it provides stability of physicochemical conditions, such as reaction in terms of hydrogen ion concentration, osmotic pressure and temperature. The values for these properties in cell fluid rest on the values at which they are held in the surrounding medium and the successful operation of vital processes requires an approximate constancy.[9]

The total quantity of extracellular fluid

* Part of the work was done in the Department of Surgery, Wayne County General Hospital, Eloise, Mich., under the direction of Dr. C. A. Moyer.

is about 20 per cent of the body weight. As shown in the illustration one-quarter lies in the vascular compartment and three-quarters in the interstitial space. The volume of fluid in the tissue cells of the body is roughly 50 per cent of body weight, two and one-half times the volume of the surrounding medium. Incoming substances enter the plasma and it is this more rapidly circulating portion which is dealt with directly by the mechanisms of regulation. On the arterial side of the capillary bed fluid moves into the interstitial space under hydrostatic pressure produced by the work of the heart. On the venous side the osmotic differential provided by the plasma proteins is unopposed and sustains a return flow into the vascular compartment. The chemical composition of extracellular fluid is shown in Figure 2.

The second concept of importance in this problem is the make-up of this extracellular fluid. This may be divided into three parts: (1) the organic solutes of small molecular size (glucose, urea, creatinine, creatine, uric acid, amino acids; (2) the inorganic electrolytes; (3) the colloidal electrolytes or the organic proteins fractions. (Figure 2.) The chief concern of the clinician in the problems of water balance is with the inorganic electrolytes. For that reason the discussion will be confined to this group.

The third term which must be understood in order to quantitatively evaluate the electrolyte content of the extracellular fluid is the definition of milliequivalents per liter. This term is defined as the product obtained by dividing the mg. per liter by the atomic weight and multiplying by valence. In Figure 2 the electrolyte content of the extracellular fluid is measured by this means.

Disturbances in extracellular fluid equilibrium have been classified by Moyer[13] as: (1) Those of volume—(changes in relation of the extracellular salt water volume, base content of the body, to total body solids). This may be a deficit or excess, that is, a base or sodium excess or deficit. (2) Those of composition—(departure from the normal electrolyte pattern of the extracellular fluids). This may be manifested as acidosis with an alkali deficit or bicarbonate deficit or as an alkalosis manifested by alkali or bicarbonate excess. (3) Those of distribution—(variations in the extracellular salt water volume of various tissues with the total extracellular salt water volume remaining constant, that is, variations in the transfer of extracellular salt water to the site of injury). This discussion will confine itself to volume changes only.

In Figure 3 the relative amounts of sodium, chloride and bicarbonate ions in the digestive secretions are shown. The sums of the other anion and cation components are indicated at the foot of their respective columns. These remainders are estimated from incomplete data but are probably near the values given. The total quantity of electrolyte in the secretions as shown by the height of the diagrams is closely the same as in blood plasma. Also, as in plasma, the large components of their structure are $(Na+)$, $(Cl-)$ and (HCO_3-). The diagrams make clear that failure of reabsorption of these secretions will withdraw water and total electrolyte from extracellular fluid in approximately plasma proportions.[9]

The important feature of the composition of these secretions from the point of view of structural change in extracellular fluid is this departure of the $(Na+):(Cl-)$ ratio from its plasma value. This is conspicuous in gastric juice and in pancreatic juice; in the other secretions the relative quantities of $(Na+)$ and $(Cl-)$ are roughly the same as in plasma. It is clear from the diagram of the gastric juice that loss of this secretion will cause a much more rapid withdrawal of $(Cl-)$ than of $(Na+)$ from plasma. It is probable that actually there is no sodium in the acid secretion from the digestive glands of the stomach. The small quantity shown in the diagram may be explained by ad-

mixture of the alkaline secretion of the gastric mucosa. The specimen from which these measurements were obtained was taken from an isolated pouch constructed in the pyloric antrum, in which region there is no secretion of the true juice. Ordinarily, the relative quantity of this secretion is small, but in the presence of irritative conditions which provoke vomiting it becomes much larger and may reach a volume of about one-half that of gastric juice. There is, therefore, with vomiting a loss of (Na+) which may be approximately one-half the loss of (Cl−). Because of the dominating relationship of (Na+) to total ionic content of extracellular fluid

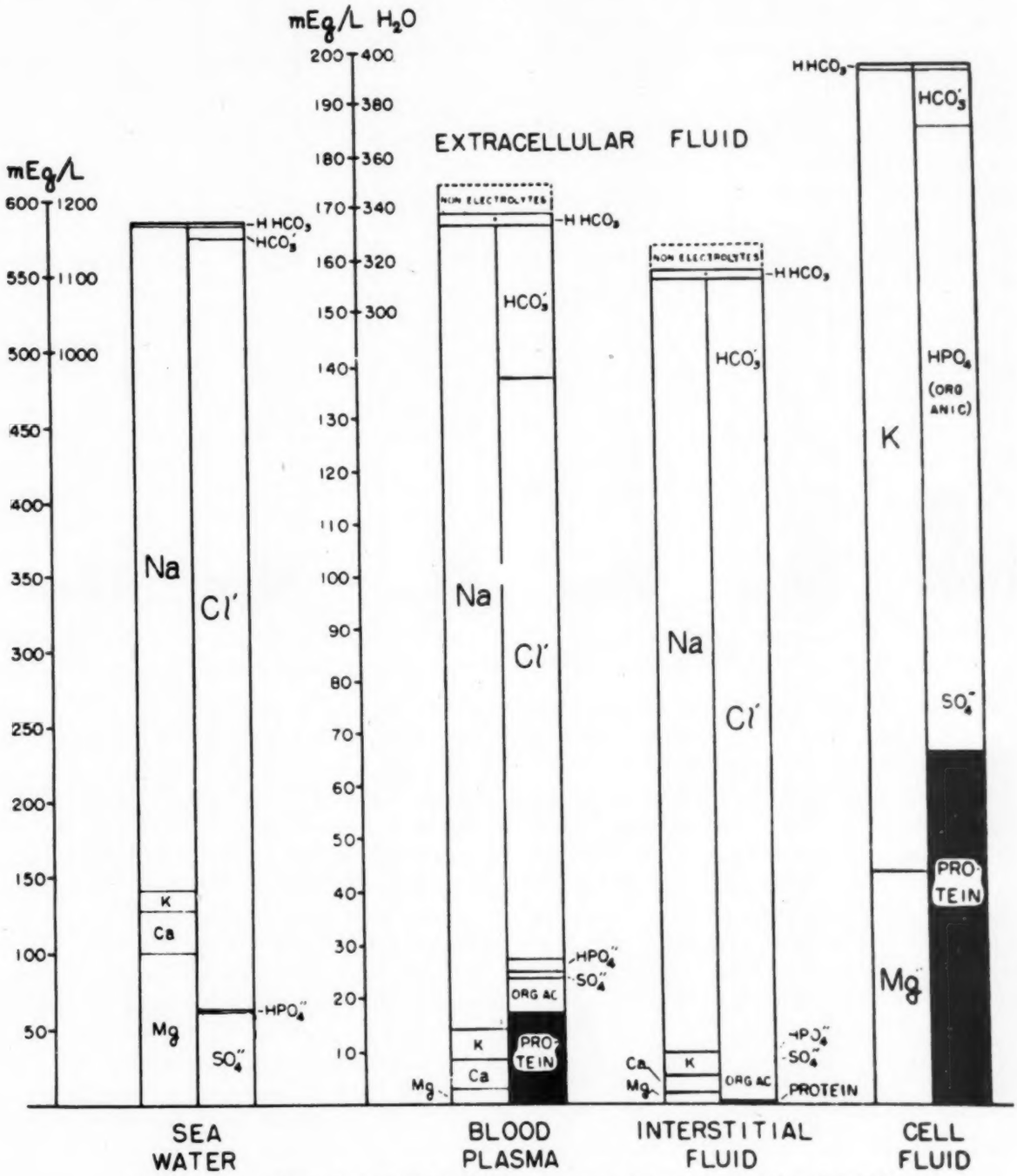

Fig. 2. Composition of extracellular fluid in contrast with sea water (after Gamble).

(Fig. 2), it is this loss of (Na+) which is significant in regard to extent of dehydration. Diarrhea causes loss of pancreatic juice which contains (Na+) in much larger excess than (Cl−). Gastric juice and all of the other intestinal secretions are, however, also exposed to loss so that (Na+) and (Cl−) are withdrawn in roughly their plasma proportions.[9]

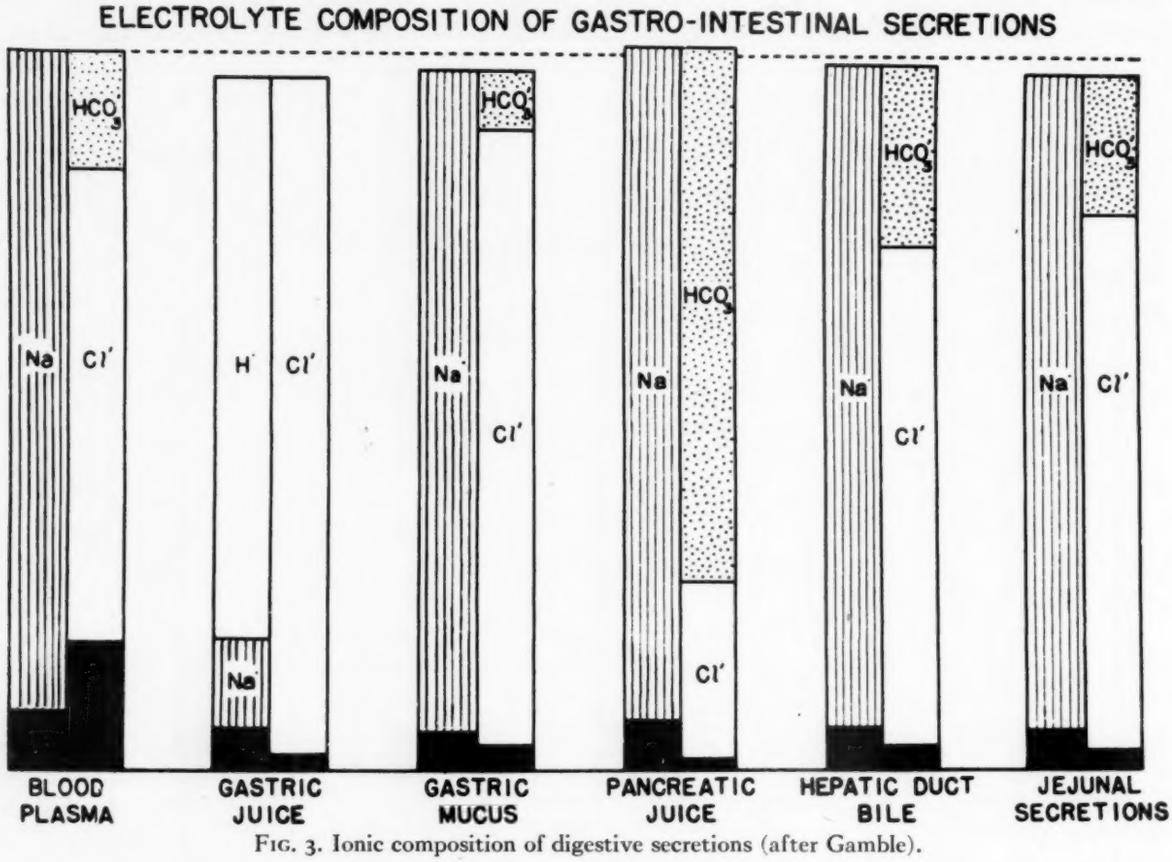

FIG. 3. Ionic composition of digestive secretions (after Gamble).

Another important fact which must be kept in mind is that well persons, nonfasting, usually eat from 2 to 9 Gm. of salt daily.[1] This, however, is no reason for the sick man who is unable to eat to receive parenterally a similar amount. What is lost sight of by those who believe this is that a man on a 1 Gm. salt intake suffers no apparent harm providing his kidneys are functioning normally and he is not losing salt by diarrhea, vomiting, etc.

Many believe that habit rather than actual need governs salt intake and that a normal healthy man has more than enough salt to maintain satisfactory health. This view is supported by quantitative salt excretion tests. The actual amount of salt needed daily during a fasting state is still undetermined but from a surgical standpoint the routine administration (parenteral) of 5 to 9 Gm. of salt daily when no abnormal loss is occurring is often detrimental and will hinder convalescence. In fact, Moyer[13,14] and others believe that a slight deficit of extracellular salt water is preferable to any excess even 5 to 9 Gm., particularly during the first few postoperative days. Certain evidence has been gathered to support this contention.

It can be easily demonstrated experimentally that salt solutions tend to collect in relatively greater quantities at sites of trauma than in normal areas.[5] An exteriorized loop of bowel or a large granulating wound will put forth far less transudate from the exposed surfaces if salt water is restricted. However, if given in excess,

the areas will swell and transudate will increase. The significance of this observation is at once obvious. The rate of healing varies inversely with the amount of edema present. As a result of edema in gastrointestinal surgery suture lines will swell with resulting leaks and delayed stomal function. Since following the principle of "slight deficit," far less trouble has been encountered following subtotal gastrectomy, resulting in an earlier removal of suction tubes.

Another site of collection for excess salt water is in the lungs. Postoperative pulmonary complications, particularly in the very young and the aged, will occur less often when the "slight deficit" principle is followed. In our experience pulmonary complications were reduced from 7 to 0.2 per cent by this means.

Experiments conducted on normal healthy adults have shown that a normal adult given a load of 0.9 per cent saline to 5 per cent of his body weight will retain approximately 40 to 50 per cent of the injected solution longer than twenty-four hours. This may be detected by weight studies. Postoperatively we are usually dealing with a patient who has suffered a certain amount of anoxia and hypotension during surgery, which in turn has resulted in some renal impairment. Because of this impairment, the retention of salt water injected parenterally will be higher, dependent upon the amount of impairment that has occurred and also on the length of time required for correction of this impairment.

If sodium chloride is given to young, healthy individuals, they will excrete it and the signs of salt retention will not appear even though 30 or more Gm. are ingested daily.[16] However, most ill patients are relatively incapable of excreting small excesses of salt even when given with large amounts of water. Coller,[3,4] Moyer[13] and others have shown experimentally that the retention of sodium is greatly increased in the immediate postoperative period and that it is not significantly altered by increasing available water. Any individual who has suffered severe trauma or surgical procedures of large magnitude, aged patients, patients with poor vascular systems and those suffering from malnutrition do not handle salt water as the normal person does and they are relatively incapable of obtaining any free water from the isotonic saline solution.

Experiments previously mentioned well illustrated the means of accumulating an excess of salt water in the human body. For example, when a man was loaded to 5 per cent of his body weight with sodium chloride solution he was found to retain about one-half of this load for over twenty-four hours. During the period of loading the maximum excretion of urine was attained; this was much less than the rate of loading, being approximately 25 per cent. Because of this, the volume of salt retained in the body steadily increased while the urinary output remained relatively fixed. After administration was stopped the rate of urine decreased as the amount of saline in the body decreased. There was a relatively constant relationship between urinary output and the remaining load of saline. Because of this slow rate of excretion, large amounts (approximately 50 per cent in some cases) of the injected solution were retained over a twenty-four hour period. This retention of sodium chloride if cumulative leads to edema, fluid collections in the body, etc.

If these observations are illustrated by means of figures, the ease with which large accumulations of salt can occur is readily seen. For example, 4,000 cc. of saline are given the first day, 2,000 cc. excreted, 2,000 cc. remain; the second day the load would consist of 4,000 cc. given, plus 2,000 cc. remaining from the day before; applying the 50 per cent retention rule, 3,000 cc. will be left over at the end of this twenty-four-hour period, etc. From this it can readily be seen how such excesses occur and also the dangers of indiscriminate use of saline.

It is well known that a deficit of extra-

cellular salt water is much more easily corrected than an excess. To remove the accumulated excess salt water places an undue burden on an already impaired kidney and unless enough free water is available to allow for insensible loss and excretion of the excess salt, oliguria or anuria may result.[5] This free water may be extracted from the saline solution by the normal kidney by excretion of salt in higher concentration in urine than in the solution administered but is best supplied orally or parenterally.[2,6,15]

In an effort to complete the understanding of the subject a few moments spent examining the etiology and clinical picture of the various types of extracellular water imbalance will enable one to understand more fully the reasoning behind the choice of repair solutions. These types will be divided into four categories to facilitate discussion:

The first of these is extracellular salt deficit. This is seen when there is persistent loss of sodium from the body (extrarenally), that is, with vomiting, diarrhea or fistula. This condition rarely exists alone and is usually associated with water deficit or in states of acid-base imbalance. When water intake is low (below that lost through the kidney, skin and lung) during a simultaneous development of a salt water deficit, this first condition will develop. The signs and symptoms of this condition may be divided into three groups, with the forerunning statement that the more rapidly the deficit occurs the more severe are the symptoms: Group I are those cases in which a deficit of from 0 to 2 per cent of the body weight exists. In a previously healthy individual there will be no detectable clinical findings, but in a chronically ill older patient weakness, anorexia, apathy and reduced effective responses will be quite marked. Group II are those patients with from 3 to 5 per cent of the body weight deficit. They suffer from apathy, weakness, somnolence, anorexia, nausea, subnormal temperature, weak pulse, low blood pressure, reduced effective responses and a definitely sticky skin. Group III are those who have over 5 per cent deficit. They are manifested by an increase in the severity of the aforementioned symptoms progressing to shock states and death as 40 per cent reduction in extracellular fluid is approached.

The second type of extracellular imbalances is an extracellular salt water deficit with water excess. This usually occurs when the sodium content of the extracellular fluid space has been lowered by actual loss and that which remains is diluted by water that is drunk or given by vein. Such a condition is frequently seen in various enteric fistulas, chronic diarrheas and granulating wounds in which the water loss has been replaced but the basic sodium loss had been neglected.

The third of the extracellular fluid imbalances is salt water excess with a relative water deficit. This is the common syndrome induced by overadministration of 0.9 per cent sodium chloride solution to the postoperative patient. The symptoms and signs are disorientation, anorexia, nausea, vomiting and oliguria with collection of fluid in the subcutaneous tissue, lungs and body cavity.

The fourth of these is salt water deficit with a water deficit. The cause of this condition is the loss of extracellular fluid at a more rapid rate than it can be acquired while no water is being taken or given. The clinical causes are those in which there is a loss of sodium such as vomiting, diarrhea or fistulous drainage. In these conditions the intake of water is at a slower rate than its insensible loss through the skin and lungs. The signs and symptoms of this condition are similar to those of extracellular salt water deficit alone plus oliguria and an increase in blood urea.

Laboratory signs of the aforementioned states vary with amount of deficit, rate of development and with cause of deficit. From this it can be seen at once that laboratory findings are dependent on so many variables that their actual worth is often questionable.[1]

The finding of "normal" blood solute or

red blood cell concentrations does not rule out the presence of an extracellular salt deficit. However, a diminution of the solute concentration (Na+ and Cl−) with an increase in the concentration of red blood cells (high hematocrit) is positive evidence that a relatively severe and rapidly developed extracellular salt water deficit exists. The relationship of the changes in solute and red blood cell concentrations to the salt water deficit are qualitative but usually not quantitative. Therefore, clinical examination often constitutes the best basis for ascertainment of the existence of salt water deficit.

Distributional shifts in extracellular fluid such as occur when salt water travels to a traumatized area and changes in composition of extracellular fluid are purposely omitted so as not to overcomplicate the discussion. Acid and base changes are also very important and will be discussed in a later paper.

Nevertheless, in administering fluids it is important that it be carried out in accordance with modern concepts of fluid balance. In a canvass of fifty of the smaller community hospitals in Illinois several common abuses were quite generally encountered in administration of fluids directly arising from a violation of such concepts.

The first of these was the overuse or overloading of the postoperative patient with normal saline solution. This was common practice in about 95 per cent of the hospitals reporting, and often the actual selection of the fluid was left to the discretion of a nurse rather than prescribed by the doctor in charge of the patient. The most commonly used solution in this No. one abuse was 5 per cent glucose in 0.9 per cent saline given in amounts of 2,000 to 4,000 cc. daily for several days postoperatively when no known source of salt water loss could be ascertained for the patient in question. The dangers of this procedure have been mentioned previously.

The second abuse was in failure to replace specific ionic losses by means of the proper repair solutions. In most cases no matter whether the loss was from the stomach or ileum the repair solution was always 5 per cent glucose in 0.9 per cent sodium chloride.

The third abuse was use of parenteral fluids when oral fluids would have accomplished the same purpose. It has been the prevailing feeling in many places that the postoperative patient should not be given fluids by mouth. This is entirely erroneous. The only patients who should not receive oral fluids postoperatively are those who are nauseated or who have had gastrointestinal surgery. In this latter type of surgery one may desire to diminish peristalsis or avoid washing out chlorides through stomach suction tubes.

The fourth abuse was failure to provide enough free water for kidney function. The usual procedure in a patient who has a low urinary output is to use 25 or 50 per cent glucose to stimulate urinary outflow. This will only work when sufficient water and salt are available in the extracellular fluid. Often the cause of oliguria is a shortage of free water and as a result glucose will ordinarily not be effective and if it is effective it will only aggravate the deficit of water that is present. If an attempt is made to force urine flow in the presence of a salt deficit with 5 or 10 per cent glucose before the correction of the extracellular salt deficit, severe water intoxication may be induced and anuria results.

Hypertonic glucose solutions alone, while causing a temporary increase in urine by pulling water from the intracellular to the extracellular spaces, soon cause a reversal as the glucose passes into the cell because they draw water into the intracellular space producing a more acute extracellular water shortage in the extracellular space than existed before. To overcome this, 5 per cent or preferably 10 per cent glucose in distilled water should be administered as the source of free water for the body.

The fifth and last abuse noted in this survey was the basing of treatment of the

patient upon laboratory findings rather than the clinical picture. The pitfalls of this method have just been discussed.

In administration of fluids either parenterally or orally as repair solutions one must keep in mind the approximate losses which he is attempting to replace. These have been fairly accurately worked out by Coller et al.[3] Two factors must be taken into account: They are first, the actual fluid loss from urine, vomiting, drainage, suction or fistulas, and second, insensible fluid loss, chiefly from the skin and lungs as water vapor not containing salt. This latter factor may be roughly figured as totalling about 1,000 cc. per day.

Before discussing the reasons for use of the solutions in the mentioned examples let us preface it by saying again that it is always easier to correct a water deficit than to correct a water excess and that the clinical picture of the patient is the final measure of the amount of solution to be used. Whenever possible, repair solutions should be administered orally. The two that are most effacious are: first, the hypotonic type composed of 3 Gm. of sodium chloride plus 1.5 Gm. of sodium bicarbonate dissolved in 1,000 cc. of water; second, the hypertonic type composed of 6 Gm. of sodium chloride plus 3 Gm. of sodium bicarbonate dissolved in 1,000 cc. of water. These solutions are not, as some contend, unpalatable and when chilled they make efficient replacement for extracellular fluid loss from such complications as intestinal fistulas, diarrhea, wound drainage, etc.

When unable to give fluids by mouth, we must resort to the parenteral route. The five stock repair solutions in use are as follows:

Glucose Solutions in Distilled Water. Most attention will be paid to the 5 per cent glucose, the so-called isotonic solution. This type of solution is indicated when one desires to replace acute water deficits in the face of normal extracellular fluid space components or nutritional losses. How much of these solutions are we to use? This is answered by the statement that enough solution is used to return the patient as nearly as possible to normalcy. (Normal status mentally, physically and objectively.) Remembering that true dehydration cannot be treated by administration of dextrose alone, saline must be given for this correction if extracellular fluid is deficient. The other glucose solutions, 10 and 15 per cent, are used to provide food.

Sodium Chloride Solutions. It has been pointed out by Dr. Coller that saline solutions of 0.45 to 0.6 per cent are functionally more isotonic with tissue cells than the 0.9 per cent sodium chloride which is probably only isotonic with the red blood cells and, therefore, hypotonic saline solutions make better repair solutions than the so-called isotonic solution. If saline is being lost through suction, sweating or drainage etc., it is best replaced by giving milliequivalent for milliequivalent lost. While isotonic solutions of sodium chloride are widely used because of their ease of preparation and general availability, it has been known for years that isotonic solutions of sodium chloride are not entirely satisfactory for replacement of electrolytes and water. The work of Drs. Darrow,[7,8] Moyer[13] and Coller[4] et al. indicates that for the proper electrolyte replacement of extracellular fluid, sodium, chloride and bicarbonate or lactate ions in the infusion solution should be supplied in the same milliequivalent values as those ions are found in the normal extracellular fluid. Since the sodium chloride solution supplies only the sodium and the chloride, administration of this solution will supply an excess of the chloride radicle. This excess of chloride in the extracellular fluid space may produce severe disturbances in acid-base equilibrium and places an added load upon the kidney to eliminate the excess amount of chloride.

*The solution, isonate,** contains sodium bicarbonate in addition to sodium chloride thus maintaining the buffer value of the body fluids and reducing the work

* A product of The Upjohn Company, Kalamazoo, Mich.

load of the kidney.[8,16] Use of such solutions containing sodium bicarbonate have long been known and recommended as a means of preserving the alkaline buffer of the blood and of counteracting potential or actual acidosis usually associated with dehydration due to loss of fluids following surgical procedures or loss of fluids due to burns, infection and diarrhea. The difficulties encountered in preparation of such solutions have until recently prevented their adoption for routine purposes. The solution isonate meets all the requirements aforementioned; it contains 0.644 Gm. sodium chloride, 0.252 Gm. sodium bicarbonate and 0.018 Gm. potassium chloride.[8]

Hartmans Solution. This is well known to the medical profession and performs a valuable service as a repair solution. It provides not only the electrolytes, sodium, potassium and chloride, but also racemic lactate which when converted to the bicarbonate ion acts as a buffer in the body fluids and therefore has an effect similar to isonate.[18] Hartmans solution and isonate solution provide the best repair solutions when intestinal fluids are being lost from enteric fistulas, biliary or pancreatic fistulas or long intestinal suction tubes.

Sodium lactate solutions ranging in strength from ⅙ to ½ molar have been found useful for their diuretic action as well as their buffering qualities. The diuresis is caused probably by the addition of an excessive sodium ion into the extracellular space.

In conclusion a few specific examples of the proper choice of repair solutions for a given patient are cited together with an explanation of the reasons for such choice.

The first example is that of a postoperative patient in the first twenty-four hours following hysterectomy who is not debilitated or dehydrated prior to the time of operation; the patient is not nauseated and is able to start taking fluids by mouth within a few hours after the operation. She should not have more than 1 liter of glucose solution to supply her water needs for the day. This may be given during the operation. In this example the average normal patient needs only a sufficient amount of water to cover the insensible loss during the first twenty-four hours after the operation.

In the second example we have a similar postoperative patient who is nauseated and vomiting following return from the operating room. A rough measurement of this patient's actual loss by vomiting should be made and replacement should be carried out using a glucose solution in 0.6 per cent saline in amounts equivalent to the amount lost in vomiting. Since this patient is losing some sodium and considerable chloride from the stomach vomitus, obviously the only needed replacement is sodium chloride plus insensible loss coverage. This is best replaced as we have previously mentioned by hypotonic saline in glucose solution.

Our third example is postoperative subtotal gastric resection during the first twenty-four hours following surgery. A suction tube is working during this period. The patient with this type of surgery should receive an amount of hypotonic saline (0.6 per cent) equivalent to that lost by the suction drainage. The remainder needed to cover the insensible loss plus the urinary output of the day before should be in the form of 5 or 10 per cent glucose in water. One must remember, of course, that if the patient has received blood in the operating room in the excess of that lost during the operation then the need of saline solution will be proportionately reduced. We must in this type of case take care to replace only that amount of sodium chloride which is lost as any excess will accumulate in the areas of trauma, that is the suture lines, and will by means of edema delay function or possibly cause actual leakage.

The last example is that of a patient with a newly working ileostomy. This patient should receive as nearly as possible an amount of Hartmans or isonate solution equivalent to the amount of drainage from the ileostomy. If this same patient, how-

ever, is able to take fluids by mouth, part of this may be replaced through the use of sodium bicarbonate-sodium chloride solution just mentioned. (Sodium chloride, 3 Gm. + sodium bicarbonate, 1½ Gm. in 1 L. water.)

Intestinal contents are basic in reaction and therefore use of the buffered bicarbonate chloride solutions with excess sodium come the closest to replacing the actual loss of any of the repair solutions available.

SUMMARY

An attempt has been made herein to point out with only the barest minimum of fundamental physiologic facts the elementary considerations which must be kept in mind when administering fluids parenterally. The methods of fluid administration now commonly employed by the smaller community general hospital were discussed together with reasons for believing that some of these are outmoded. Corrections were suggested by the use of specific examples in an effort to further clarify the problem. Relation of extracellular sodium to intracellular potassium has purposely been omitted so as not to complicate the discussion.

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EXPERIENCE WITH REFRIGERATION ANESTHESIA*

SIX SUPRACONDYLAR AMPUTATIONS FOR ARTERIOSCLEROTIC GANGRENE

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THE following brief communication is in no sense to be considered as original work and any credit for the development of either the theory or technic of refrigeration anesthesia is specifically disclaimed. It is proposed merely to cite the experience of one individual with a technic which seems particularly applicable to the type of material with which we are constantly dealing, with the hope that others will be able to utilize the method for the benefit of their own patients. While we are all concerned predominately with psychiatric problems, and it is fitting that our programs should be largely concerned with psychopathology and problems of hospital administration, it may not be amiss to interject an occasional note on physical medicine since it is all too easy for us to become overspecialized in the realm of deranged thought and to lose contact more and more with the world of general medicine and surgery. Moreover, since the admission rate for senile and arteriosclerotic patients is constantly mounting and this class of patients is definitely hampering our efforts to give adequate therapy to the more hopeful functional psychoses, it is obvious that geriatric surgery in our state hospitals is increasing and that we must seek out all possible means of giving relief to these elderly patients. Many of them are afflicted with a loathsome and foul-smelling foot or leg which makes life a burden.

Preliminary work on the effects of reduced temperature on both healthy and morbid human tissue has been done for the past ten years by a number of workers who have demonstrated that cold instead of heat is often the therapy of choice and that temperature reduction will inhibit pain, edema, infection, shock, toxic absorption and tissue devitalization. Thus, Temple Fay and associates at Temple University Medical School have demonstrated the inhibitory and destructive effects of moderate degrees of cold on normal embryonic tissues and on primitive, poorly differentiated neoplastic cells which resemble normal embryonic forms. Such cells of low differentiation survive within a very narrow temperature range and succumb readily to cold to be replaced by stronger and more specialized cells. Fay was able to cause the regression and even the complete disappearance of sloughing breast carcinomas considered to be inoperable, extensive epitheliomas of the vulva and other surface locations where it was possible to apply cracked ice directly to the affected part over long periods and reduce the temperature of the cells to about 40°F. Spectacular results have been demonstrated in patients considered to be beyond the hope of further surgery as the primitive carcinoma cells die and are replaced by healthy granulation tissue and stratified squamous epithelium. Unfortunately a method of applying this technic to malignancies of internal organs has not been developed. Hibernation of the patient with the whole body surrounded by cracked ice for weeks at a time has also been used in an effort to prolong life and retard the process in those with extensive malignancies of the abdomen. Frederick M. Allen and Lyman Weeks Crossman of the New York City Hospital have produced a mass of evidence and data concerning use

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of cold and its application to surgery, treatment of burns, prevention of surgical and traumatic shock, treatment of thromboses and emboli of the extremities and preservation of living tissues.

The present paper is concerned entirely with one limited phase of this work, namely, use of cold in the production of anesthesia for amputation of gangrenous legs in senile arteriosclerotics. Prior to adoption of refrigeration anesthesia the writer had used spinal and, occasionally, inhalation anesthesia for this type of operation. Crossman's refrigeration anesthesia technic was tried with such satisfactory results that it is now considered the anesthesia of choice for this operation. The principle involved is simple; within physiologic limits, the conductivity of nerves is directly proportional to temperature. Lowering temperature decreases conductivity. All protoplasmic activity is reduced as temperature is lowered so that cold tissues cannot respond by physical or chemical reactions to any stimulus. Amputations done with this type of anesthesia are completely without shock; there is no interference with the patient's dietary regimen (many of them are diabetic as well as arteriosclerotic), meals are eaten both before and after amputation, use of narcotics is minimized or abolished and there is minimal disturbance of the routine of those patients who stand changes badly. They have no pain whatever during the operation and are often completely unaware that an operation has been performed. All of our amputations have been done with cracked ice as the refrigeration agent. This is the most simple and probably the safest method although there are various electrically operated cooling devices that are entirely successful. The only advantage of the electrical apparatus over ice for operative anesthesia lies in its convenience and avoidance of mess. As the cost of the complete equipment is about $700.00, hospital executives may be dubious of such an expenditure for this purpose unless the number of amputations is particularly large. No harm can be caused from ice alone as it is impossible to cause frostbite of the tissues with ice. It is important, however, not to allow some zealous assistant to add salt to the ice. If this is done with the mistaken idea of hastening or improving the anesthesia, frostbite with gangrene of the wound edges and delayed healing will result.

An efficient tourniquet is essential for without complete occlusion of both arterial and venous circulations the patient will become chilled and uncomfortable and the temperature of the leg will not be properly reduced. Allen and Crossman have demonstrated repeatedly that the narrow, soft, rubber tourniquet is innocuous and that the important thing is not to injure the tunica intima of the blood vessels with a hard surface such as a cord. We have not seen a thrombosis or embolus, delayed healing or other evidences of vascular injury in our small series. It is interesting to see the popliteal artery begin to pulsate and the wound begin to ooze immediately after the vessels have been secured and the tourniquet removed. A tourniquet of ½ inch gum rubber tubing is used in two layers, one superimposed on the other, secured by two strong clamps and placed about 6 inches above the site of the amputation.

The surgeon may use whatever technic of amputation he prefers as the method of operation is irrelevant. Dr. Crossman prefers the circular guillotine type of low thigh amputation, disarticulating the knee with the scalpel and discarding the leg before transecting the femur. The patients in the six cases reported herein have been treated by the same technic, namely, a modified Carden's amputation with a medium anterior flap through the patella tendon, cutting out the patella when the flap is reflected. A very short posterior flap is used severing the hamstring tendons near their insertion, clamping, cutting and ligating the vessels and nerves in the popliteal space, injecting the nerves with 95 per cent alcohol and transecting the

femur from 1 to 3 inches above the condyles. The tourniquet is then removed by an unsterile, circulating nurse. Any new bleeding points are ligated and the sharp edges of the femur are rounded off with the raspatory. Sulfanilamide powder is sprinkled over the raw surface and the wound is closed by through and through vertical mattress sutures of silkworm gut. No drains are used and no sutures are put in the muscles. The entire operation usually takes about thirty minutes. There is no necessity for haste, however, as the anesthesia lasts well. The only important difference in the surgical nurse's procedure is that cold saline solutions for rinses are used instead of warm liquids. Refrigeration of the stump is continued by three ice bags for forty-eight hours postoperatively so that sensation and protoplasmic activity return gradually. Sutures are removed on the fourteenth day. Wound healing is delayed by both pre- and postoperative refrigeration so that earlier removal of sutures may result in gaping of the edges. Usually no opiates are needed either pre- or postoperatively although a barbiturate is usually given to prevent the patient from attempting to stand up during the first postoperative night. There is no change in the dietary regimen. The patient may be gotten out of bed into a chair or wheel chair within twenty-four to forty-eight hours and any indicated medication required for the general condition may be continued. If ice bags are applied to the site of the tourniquet for one-half hour before its application, the cutaneous nerves are numbed and the patient has no discomfort when the tourniquet is applied.

Operation may be scheduled at any time convenient to the team as long as the refrigeration process is started sufficiently far in advance to cause anesthesia. Ordinarily from two to two and one-half hours of refrigeration are required for a low or mid-thigh amputation. Excessively fat patients may require three hours. However, if for any reason the operation is delayed, the refrigeration may be continued indefinitely and no ill effects will ensue. Our refrigeration technic and preoperative orders, which are essentially those of Crossman, are as follows: local preparation of the thigh and leg; (scrub and shave the knee and popliteal areas; apply clean

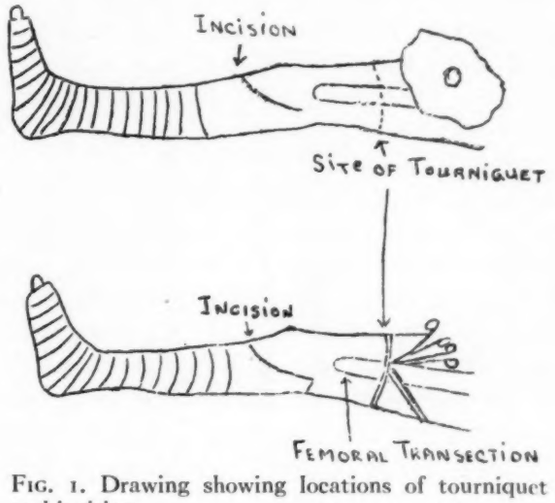

Fig. 1. Drawing showing locations of tourniquet and incision.

bandage on the gangrenous parts). Allow breakfast and lunch as usual and elevate the head of the bed. Neumbutal, 3 gr., should be given orally at 10 A.M. Apply three ice bags (one posterior and two mediolateral) to the site of the tourniquet (Hunter's canal). Remove the ice bags at 10:30 A.M. and apply the tourniquet (two superimposed layers of rubber tubing secured by two Kelly clamps laterally). Refrigerate immediately with finely cracked ice from the toes to well above the tourniquet. Wrap the leg in a rubber sheet funneled into a bucket on the floor at the foot of the bed. Continue refrigeration adding more cracked ice as needed to keep the entire leg covered. Proceed to the operating room at 1 P.M. without removing the ice. The ice is left on until the surgical team is scrubbed and ready to proceed with the operation. The ice is then removed by the operating room orderly who slides the rubber sheet and ice into a laundry hamper. The leg is then prepared and draped in the usual manner and the amputation is performed. Refrigeration of the

TABLE I

Name	Date of Operation	Age	Race and Color	Sex	Indications	Procedure	Surgical Results	Late Results	Cause of Death
M. B. admitted June 17, 1881	February 14, 1944	80	American negro	F	Wet gangrene of right foot and leg	Right supracondylar amputation	Uneventful recovery	Died February 15, 1945	Bronchopneumonia; arteriosclerotic cardiovascular disease
L. S.	March 7, 1945	69	White; native born; Danish parentage	M	Wet gangrene of right foot	Right supracondylar amputation	Uneventful recovery	Died April 13, 1945	Bronchopneumonia; arteriosclerotic cardiovascular disease
R. P.	July 5, 1945	62	White; Italian birth and parentage	M	Wet gangrene of left foot and leg; diabetes mellitus	Left supracondylar amputation	Uneventful recovery	Died September 16, 1945	Cerebral hemorrhage; arteriosclerotic cardiovascular disease
R. S.	March 18, 1946	77	White; native born; unknown parentage	M	Wet gangrene of left foot; (recent amputation of right thigh)	Left supracondylar amputation	Uneventful recovery	Died May 6, 1946	Bronchopneumonia; arteriosclerotic cardiovascular disease
P. M.	June 24, 1946	83	White; Italian birth and parentage	M	Wet gangrene of right foot and leg	Right supracondylar amputation	Uneventful recovery	Living and well October 15, 1946	
C. D.	September 11, 1946	Unknown (about 70)	White; Lithuanian birth and parentage	M	Wet gangrene of the left foot	Left supracondylar amputation	Uneventful recovery	Living and well October 15, 1946	

stump with three ice bags is continued for forty-eight hours postoperatively.

SUMMARY

Of the six cases mentioned in Table 1 there were five men and one woman. The ages ranged from sixty-two to eighty-three, with an average age of 73.5 years. Of the six amputations three were performed on the right thigh and three on the left. One of the six had diabetes mellitus. It is interesting to note that the patient, Case IV, on whom a left-sided amputation was done, had had a right supracondylar amputation for the same condition before coming to this hospital. It is also interesting that M. B., Case 1, entered the Trenton State Hospital on June 17, 1881, at the age of seventeen and had been in various state hospitals of New Jersey continuously almost for sixty-four years when she finally died.

Prior to the introduction of refrigeration anesthesia the operative mortality for this type of operation at the New York City Hospital ranged from 55 to 80 per cent, deaths being due chiefly to shock, infection and embolism. In this series the operative mortality was zero. All of the patients made normal, uneventful convalescences. The last two patients were still living, approximately four months and one month postoperatively.

CONCLUSION

While this series is too small to justify any conclusions in itself, it is believed that these six cases added to the experience of other surgeons tend to confirm and reinforce the conclusions that refrigeration anesthesia is a highly satisfactory and safe technic in amputations of the lower extremity for senile arteriosclerotic gangrene.

ACUTE DISEASE OF THE PORTAL VEIN

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DISEASES in which there is little hope for cure constantly challenge the medical profession. As such, acute disease of the portal vein merits study although there is little to be done about it except to make heroic attempts to avoid it. Portal vein thrombosis occurs most often in conditions in which blood is stagnant in the portal vein. Portal vein infection complicates severe peritoneal infections; appendiceal infections precede it more often than anything else. The incidence of acute portal vein disease is not determined for it is of such a nature that it is rarely diagnosed until the patient is moribund. It is impossible to say how many patients may have a small infection or thrombus in the portal vein which may disappear and leave no residual symptoms. Undoubtedly the specific drug therapy available to us in the past few years has lowered the possibility of portal vein infection and perhaps has minimized what might have been a fatal complication.

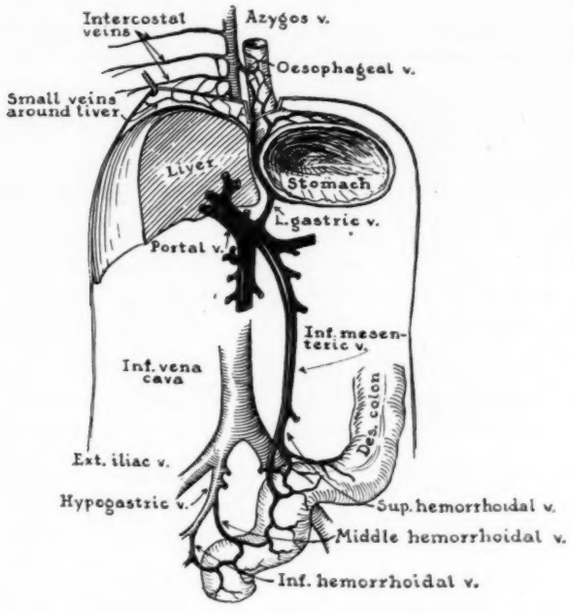
Thrombosis of a vessel implies partial or complete obstruction of the vessel by clotted blood; infection of a vessel implies invasion of micro-organisms to or into the vessel. A combination of the two processes is a result when the obstructing material is infectious. If the thrombus originates in the vessel wall, the disease is called thrombophlebitis; if the thrombus originates from a blood stream disorder, the disease is called phlebothrombosis; if the material inside the vein is frankly purulent, pyemia exists and if this is in the portal vein, it is called pylephlebitis. In some instances production of the process may involve all three of the previously mentioned conditions for example when an abscess erodes into the vessel. In these cases one calls the process thrombophlebitis or pylephlebitis depending on the degree of infection of the invading material.

The production of thrombi is initiated by three major factors: slowing of the circulation, trauma to the intima and increased tendency to clotting. Frequently a combination of these processes is present. In stagnant blood the heavier cellular elements of the blood settle to the bottom while the plasma circulates on top. Within the plasma are the platelet cells; these have a tendency to stick to any raw or injured surface encountered; therefore, if the circulation through an injured vessel is slow, clot formation may occur. Vascular injuries caused by trauma, stretching, bruising or infection are dangerous in that thrombi may form at the injured spot. Infection of tissues near blood vessels frequently reflects the general inflammatory reaction into the wall of the blood vessel and thus thrombi are formed. Increased tendency to clotting may arise from several causes, most of which depend on the balance of fibrinogen, calcium and prothrombin. Calcium and prothrombin react together to form fibrin on which a clot is built. Thrombokinase is a catalyst to the formation of thrombin; heparin counteracts the effect of thrombokinase. Thrombokinase is liberated into the blood stream after any tissue injury, particularly muscle injury; in massive injuries a great deal of thrombokinase may be present so that it overbalances the heparin in the body and thereby coagubility of the blood is enhanced.

When conditions exist for the production of thrombi or infection inside a vessel, propogation of the process is the natural course. Once there is a thrombus there will be eddying or stagnation of blood immediately beyond the thrombus and here further clotting may easily take place. From time to time small bits of the thrombus may break off and be carried by the blood stream to lodge at some place

down the line. If these materials carry bacteria, small abscesses are formed at the final resting place.

When these processes take place in a peripheral vessel, the net result to the entire organism is that of dysfunction of the part affected. When these processes take place in the portal vein, the intestinal tract and the liver are the parts affected; the drainage of blood from the intestinal tract is interfered with and the liver does not receive its major supply of blood. If it is remembered that the liver is the first collector of blood which has been absorbing materials from the intestinal tract and the liver has several paramount functions of assimilation and detoxification the importance of this obstruction will be appreciated.



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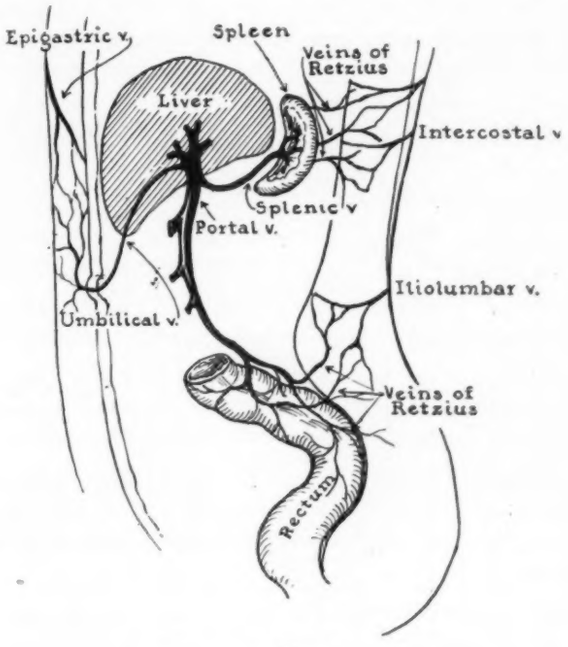

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Figs. 1 and 2. Natural anastomotic shunts by which blood may by-pass the liver in portal obstruction.

A review of the anatomy involved will facilitate an understanding of the problem. It will be remembered that the blood below the diaphragm returns to the heart through two systems: the portal system and the inferior vena caval system. In general, the alimentary tube and the intraperitoneal organs are drained by the portal system; the abdominal wall, retroperitoneal organs of the abdomen and pelvis and extremities are drained by the caval system. Inferior vena cava arises at the junction of the two iliac veins and ascends to the heart in close approximation to the abdominal aorta. The portal system consists of the portal vein and its tributaries; the portal vein is a short trunk formed by the confluence of the superior mesenteric and splenic veins; the smaller radicles come from the intraperitoneal structures. The portal vein branches out in the liver to deliver blood to all parts of the liver. In close approximation to the branches of the portal vein within the liver are branches of the hepatic artery and from these two systems, the portal vein and the hepatic artery, the liver receives its blood. The hepatic vein picks up the blood in the liver and returns it to the inferior vena cava.

When there is portal vein obstruction, hypertension of the portal system develops; an attempt is then made to compensate for this by development of the following collateral circulation (Figs. 1 and 2): (1) Left gastric veins of the portal system anastomose to epigastric veins of the caval system; (2) superior hemorrhoidal veins

of the portal system anastomose to inferior and middle hemorrhoidal veins of the caval system; (3) small veins around the liver (veins of Sappey) of the portal system anastomose to intercostal and diaphragmatic veins of the caval system; (4) paraumbilical veins of the portal system anastomose to epigastric veins of the caval system; (5) veins of Retzius drain retroperitoneal portions of abdominal viscera.

It should be pointed out that this collateral system is developed only when there is gradual onset of portal obstruction as in cirrhosis of the liver or malignancies encroaching on the vein.

In cirrhosis of the liver there has been a great deal of difference of opinion as to exactly what causes death. Beckman does not believe it is from hepatic insufficiency but rather from the results of portal hypertension; he suggests that if relief can be obtained from portal hypertension the problem is not so great. Many observers have noticed that in cirrhosis the patient does badly early in the disease but then in many cases does very well for a few months; they postulate that this remission of symptoms is due to the functioning of the collateral circulation which slowly becomes efficient. It is true that the liver has another source by which it may receive blood, the hepatic artery, and it is possible that blood may be delivered to the liver by this route for the various detoxification and assimilation processes accomplished in the liver.

TABLE I

ACUTE PORTAL VEIN DISEASE AT VANDERBILT UNIVERSITY HOSPITAL FROM 1933 TO 1946

	Age	Race	Sex	Clinical Diagnosis	Autopsy Finding (Portal Vein)	Portal Vein Disease is Secondary to	Condition of Liver	Result	Autopsy
1	63	W	F	Duodenal ulcer	Thrombosis	?	Congestion	Died	Yes
2	57	W	M	Mesenteric thrombosis	Thrombosis	?	Hemochromatosis	Died	Yes
3	10	W	M	Banti's disease	Thrombosis	Cirrhosis	Cirrhosis	Died	Yes
4	53	W	F	Cholecystitis; liver abscess	Thrombosis	Abscess	Abscess	Died	Yes
5	39	W	M	Cirrhosis	Thrombosis	Cirrhosis	Cirrhosis	Died	Yes
6	12	W	F	?	Pylephlebitis	Appendicitis	Abscess	Died	No
7	15	W	F	Appendicitis; pylephlebitis	Pylephlebitis	Appendicitis	Abscess	Died	Yes
8	29	W	M	Liver abscess	Pylephlebitis	Appendicitis	Abscess	Died	Yes
9	54	W	F	Pylephlebitis	Pylephlebitis	Appendicitis	.....	Died	No
10	16	W	M	Appendicitis; pylephlebitis	Pylephlebitis	Appendicitis	Abscess	Died	Yes
11	29	W	M	Liver malignancy	Obstruction	Hypernephroma	Malignancy	Died	No
12	33	W	M	Traumatic condition of the abdomen	Obstruction	Retroperitoneal hematoma	Normal	Cured	

This concept of cirrhosis has been presented in order to compare the problem of acute portal vein obstruction. When there is rapid development of portal hypertension, there is probably little chance for compensation by collateral circulation for the collateral veins are small when first called upon for this purpose. Blood does not reach the liver from the intestinal tract; the various liver functions do not take place and the resultant effect on the body is that of hepatic insufficiency. Another difference between the problem of thrombophlebitis of the portal vein and of cirrhosis is that the obstruction may be close to the intestinal tract so that no blood can escape from the part of the intestinal tract involved, thereby producing wet gangrene of the tissues affected. Furthermore, the thrombus may be propo-

gated so that finally liver thrombi, or if infected, liver abscesses are present.

Thrombosis and infection of the portal vein are not frequent. (Table I.) In thirteen years at Vanderbilt Hospital there were only twelve cases of acute disease of the portal vein. Five of these were thrombosis of the portal vein, five were pylephlebitis and two were extrinsic obstructing lesions. In no case was thrombosis accurately diagnosed before death; in three of the five cases pylephlebitis was suspected before death but no satisfactory treatment was devised. In only one of the twelve cases did the patient survive and this was in a case of retroperitoneal hematoma which was reduced by operative manipulation and reduced in time to relieve the portal hypertension. Thus, there was one cure in twelve cases of acute portal vein disease, or a mortality rate of 91.66 per cent. There was a mortality rate of 100 per cent in pylephlebitis of the portal vein and a mortality rate of 100 per cent in thrombosis of the portal vein. The finality of these facts should be tempered with the possibility that mild degrees of these diseases may occur and then resolve so that we are never aware of their presence.

In the five cases of thrombosis of the portal vein cirrhosis of the liver was primary in two cases, purulent gallbladder disease and liver abscess was primary in one case and no demonstrable cause was found in two cases. Apparently then, in three cases of five at least, stagnation of blood due to obstruction in the liver was responsible for the formation of thrombi in the portal vein. Acute gangrenous appendicitis was primary in all five cases of pylephlebitis. In most of these cases the autopsy report included statements such as: "when the portal vein was incised, thin creamy purulent fluid ran out freely," indicating that in these cases an abscess had literally developed in the vein. Whether or not this originally was a thrombus which had become necrotic or whether the appendiceal abscess eroded into the vein directly is speculatory.

The best treatment against phlebothrombosis, thrombophebitis or pylephlebitis of the portal vein is prevention. Increased attention to the factors just mentioned may help to prevent its occurrence. The factors about which something can be done are the following: reduction in severity of infection by the judicious and prophylactic use of chemotherapy; reduction in operative trauma of vessels; reduction in operative trauma of tissues so that less thrombokinase will be liberated; use of heparin to counteract thrombokinase when thrombosis is feared; drainage of abscess which might erode into vessel walls; removal of extrinsic pressure on the vessel which might cause stagnation of blood and the general use of good surgical judgment.

When the process is present, however, it is of no immediate value to discuss prevention. A discussion of the treatment of this problem involves first a discussion of the accurate diagnosis of the problem. In studying the records of twelve patients with acute portal vein disease at Vanderbilt Hospital it was obvious that in the few cases in which the disease was suspected it was not apparent until shortly before death and as a result an analysis was made to find ways in which an early diagnosis could be made. (Table II.) In all of these cases there was an elevation of the leukocyte count and ascites and jaundice were present; in the only two cases in which a van den Bergh test was made the result was biphasic; serum proteins were reduced in two cases with the reduction primarily in the serum albumin. Blood cultures were inconstantly positive but were positive in two of the five patients with pylephlebitis.

In any case in which there is rapid production of ascites, jaundice, leukocytosis, febrile reaction, reduced serum albumin and evidence of hepatic failure one should think of acute obstruction of the portal vein. When these symptoms appear following acute intraperitoneal infection, particularly following acute gangrenous appendicitis, one should think of pylephlebitis.

In pylephlebitis there is no known treatment once the disease is well established. Multiple liver abscesses form early when the portal vein contains pus. The only thing one can hope for is to establish treatment early enough in the disease to abort it. The use of penicillin, streptomycin, sulfonamides or a combination of them is obviously important. The drug will probably reach the portal system fastest and in greatest concentration if absorbed through the gastrointestinal tract. If this tract already has no venous circulation, then it will be difficult to reach the portal system by this or by any other method other than direct intubation; and it will require courage to subject a patient, already moribund, to drainage of the portal vein with perhaps resection of a portion of the gastrointestinal tract which will already be gangrenous both from loss of venous circulation and from the original infection.

If the obstructing mass in the portal system is high enough in the portal system, that is in the portal vein itself, the condition could be relieved by ligation of the portal vein and the establishment of collateral circulation for blood to by-pass the liver. This approach would be feasible in extrinsic obstructing lesions near the portal vein or possibly in thrombi arising due to cirrhosis of the liver. Several operations have been devised to attempt to by-pass the liver, including various operations attempting to promote anastomosis between veins of the abdominal contents and the epigastric veins of the abdominal wall; none of these have been generally successful. The Eck-fistula, in which a side-to-side anastomosis of the portal vein and inferior vena cava was made with subsequent ligation of the portal vein, has not been successful because of the inevitable production of thrombi at the site of the anastomosis. Whipple, however, reports doing five Eck-fistula operations recently using a non-suture technic with vitallium tubes with good results. Blakemore and Lord report a portocaval anastomosis technic of uniting the ends of splenic and left renal veins after performing a splenectomy and left nephrectomy. All of these operations have been performed for cirrhosis. It may be that this operation will also be useful in high thrombosis of the portal vein.

TABLE II

LABORATORY STUDIES IN TWELVE CASES OF ACUTE PORTAL VEIN DISEASE AT VANDERBILT UNIVERSITY HOSPITAL

Ascites	Blood Culture	W.B.C.	Serum Proteins			Icterus Index	Van Den Bergh
			Total	Albumin	Globulin		
800 cc		25,000	7.1	4.9	2.1		
Yes		16,500					
Yes		23,000					
2,000 cc	B. coli	9,800	...	...	...	60	
Yes		12,000					
1,500 cc	Negative	11,000	4.6	2.4	2.2		
Yes	B. coli	19,000	...	...	...	26	Biphasic
800 cc	Strep.	25,000					
		17,500	5.9	3.5	2.4	25	Biphasic
300 cc		15,000					
Yes		12,000					
Yes		15,000					

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Shumacker, Jr. et al. review the effects of dicumarol and other anticoagulants in performing surgery on aneurysms, fistulas, etc., and conclude that reparative surgical procedures upon peripheral arteries can be done safely when the patient is under the full effects of such anticoagulant therapy. (*Richard A. Leonardo, M.D.*)

HYPERPARATHYROIDISM*

AN ANALYSIS OF TEN CASES WITH SPECIAL REFERENCE TO EARLIER DIAGNOSIS

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ALMOST fifteen years have passed since Albright and his associates first presented their work which gave the medical profession the physiologic basis for understanding hyperparathyroidism.[1] Since then many authors have noted the early symptoms of this disease,[1-6] but the diagnosis is still most frequently made after serious skeletal complications or irreparable renal damage have occurred. The insidious nature of hyperparathyroidism and its varied manifestations often make the diagnosis a difficult one. Albright has repeatedly suggested certain criteria for suspecting the disease.[1,8] X-ray and laboratory aids for confirming the diagnosis of hyperparathyroidism have been re-emphasized many times. Only by recognizing the early symptoms of this disease can the diagnosis be suspected and the confirmatory measures be employed. The debilitating and frequently irreversible complications demand early recognition of the disease.

Ten cases of hyperparathyroidism that have been diagnosed and in which the patients have been operated upon at the University Hospital are presented with emphasis on those factors which could lead to an earlier recognition of this condition. The first case of proved hyperparathyroidism in this clinic was seen in 1933. This diagnosis was not made again for seven years, but since 1940 nine other cases have been recognized and the diagnosis proved by operation and pathologic study. Six of these cases were diagnosed at the University Hospital and four were referred with the diagnosis already made.

CASE REPORTS

If the diagnosis of hyperparathyroidism is to be made in the early phases of the disease, it is necessary to emphasize the symptoms which will cause the physician to suspect its presence. For this reason details of histories of these patients are presented to demonstrate the symptoms which occur relatively early in the course of hyperparathyroidism. The essential x-ray and laboratory data for all of the cases are summarized in the accompanying tables.

CASE 1. A forty-seven year old housewife was admitted to the University Hospital December 6, 1933. Three years prior to admission she developed "rheumatism" characterized by painful, swollen ankles. This was transitory except for slight residual tenderness. Six months prior to admission she had an attack of pain in the left chest occurring on change of position. There was also associated nocturia six times nightly, burning on urination and cloudy urine. The patient was in bed for seven weeks during which time these symptoms apparently abated. Three weeks prior to admission she began having a slightly productive cough, pain in the lateral aspects of the chest and night sweats. The pain was exaggerated by coughing, lying down, turning and walking and was relieved by sitting in a chair. There was also some epigastric discomfort related to meals. Occasional ankle edema with dependency had occurred for six months. Weight loss during the year had amounted to 30 pounds.

Physical examination pointed to an anemia, left lower lobe pulmonary disease and acromegaly. The latter diagnosis was based on osseous enlargement of ankles, feet, wrists and hands with thick tapering fingers, moderate prognathism and mild bitemporal hemianopsia. Subsequent x-rays showed large frontal sinuses and a large sella turcica. The pulmonary disease proved to be bronchiectasis and the anemia was hypochromic, microcytic in type. The evidence of pituitary dysfunction and anemia lead to skeletal x-rays which showed generalized skeletal demineralization. Calcium and phos-

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phorus determinations suggested hyperparathyroidism.

The patient refused operation and she was discharged on a medical regimen. She felt fairly well for several months and then the symptoms returned. Three weeks before her second admission the pain in the ribs became greatly exaggerated and there was increase in weakness and pain in the back. Examination, x-ray and chemistry studies were essentially the same as on the first admission. A parathyroid tumor was removed at operation.

Comment. The symptoms of this patient for the most part were not very suggestive of hyperparathyroidism and the diagnosis was established only after tenacious endeavor to explain the multiple symptoms and signs. In retrospect the chest pain may have been related to changes in the ribs. The history of painful, swollen ankles and occasional ankle edema seemed rather insignificant yet these were due to the parathyroid dysfunction. The anemia had no known basis. There was no history of chronic hemorrhage and so it was assumed that it was the result of hematopoietic interference. Hyperparathyroidism is well recognized as being one of many causes of obscure secondary anemia.[1] The association of acromegaly with hyperparathyroidism is a rarity.[7] The exact relationship between the two diseases is uncertain.

Case II. This patient was a twenty-five year old man who began having generalized aching in the lower extremities two years before admission. Six months later he had a sudden onset of intermittent renal colic. This was followed by hematuria and passage of calculi on several occasions. Additional renal calculi were reported as having been visible in the roentgenogram. The patient had several mild episodes of urinary tract infection after this but these were reported as responding satisfactorily to sulfonamide therapy. However, a roentgenogram of the abdomen revealed that the renal calculi were increasing in size and cystic areas were present in the pelvis and upper femora. After calcium and phosphorus determinations were obtained, the diagnosis of hyperparathyroidism was made. The patient was sent to the University Hospital where a parathyroid tumor was removed at operation.

Comment. It should be stressed that while roentgen evidence of skeletal involvement was present in this case, it need not be present in hyperparathyroidism.[8] The renal involvement in hyperparathyroidism is well known and it should be emphasized that the renal symptoms are of extreme importance. Cope[4] reports that 55 per cent of seventy-eight cases had renal calculi without any skeletal changes being present and that the diagnosis has been achieved by performing calcium and phosphorus determinations routinely in all cases with renal calculi. The exact incidence of hyperparathyroidism in patients who have renal calculi is not known but it is Cope's impression that it may be 10 to 15 per cent.

Case III. Ten months before admission this fifty-six year old woman had a giant cell tumor removed from the right maxilla and a month later another was removed from the left mandible. She was then asymptomatic until five months prior to admission when the right leg became "lame" without any history of trauma. This symptom continued unchanged. Six weeks before admission she jarred her right arm while going downstairs. It became quite tender and there was some pain on motion. X-rays revealed marked skeletal demineralization and multiple bone cysts; there were fractures of the right humerus and right femur. A left renal calculus was present but had produced no symptoms. The diagnosis of hyperparathyroidism was confirmed by removal of a parathyroid adenoma at operation.

Comment. The giant cell tumor referred to by the patient was probably an osteoclastoma though we have no proof of this. However, it is pertinent to regard cystic deformities of the maxilla and mandible as possibly resulting from parathyroid hyperfunction until proved otherwise.[1–3] The development of persistent pain in the extremities occurred five months prior to fracture. This should be borne in mind as an important symptom. The renal calculi produced no symptoms until one and a half years postoperatively. She then had

two episodes of colic and passed a small calculus. Retrograde pyelograms revealed bilateral renal calculi. The serum calcium at this time was 11.8 mg. per cent and the phosphorus was 3.0 mg. per cent.

Case IV. A twenty-six year old woman first noted a dull pain in the left hip two and one-half years before admission. The pain was associated with a limp; these symptoms were continuous and gradually progressive. One year before admission she suffered a fall with a resultant fracture of the left patella which was treated by internal wire fixation. Following this she always walked with a crutch or a cane. There was increasing fatigue and some edema of the feet, both of which were exaggerated by weight-bearing. Six months prior to admission the pain became worse and persisted to admission. Three months before her admission she had given birth to a normal infant. A 20 pound weight loss had occurred during the year. X-rays showed cystic lesions in the pelvis and ribs interpreted by another radiologist as probable metastases from a Ewing's tumor. Our studies lead to the diagnosis of hyperparathyroidism and a parathyroid tumor was excised.

Comment. This is such a typical history of the skeletal type of hyperparathyroidism that attention should be called to the onset of persistent pain in the lower extremities a year and a half prior to fracture and two and one-half years before the diagnosis was made. Certainly all cystic areas in bone, especially in the long bones, pelvis, ribs and patella should be regarded with suspicion until calcium and phosphorus determinations are made to rule out this disease.[1–4]

Case V. This patient was a seventeen year old white girl. For two years she had noticed progressive weakness and fatigue. A year later she began to have a persistent aching type of pain in her knees, legs and arms. Seven weeks before admission she stumbled on the school steps fracturing the left humerus. X-ray examination showed a pathologic fracture. Four days later the patient had the onset of right flank and abdominal pain, diarrhea, several episodes of vomiting and a temperature of 99.5 to 100.0°F. Pain and fever subsided but the diarrhea persisted. While in bed, she incurred a fracture through a cystic area of the right femur. Extensive studies carried out by her physician established a tentative diagnosis of hyperparathyroidism and renal tuberculosis. There were no urinary symptoms except daytime frequency every two hours and nocturia twice nightly. The diagnosis of bilateral renal tuberculosis was confirmed. There was no associated pulmonary disease. At operation a parathyroid adenoma was found and excised.

Comment. This patient had persistent pain in the lower extremities for a full year before fracture occurred. Had this been recognized as an important symptom and the disease diagnosed and treated at this point, fracture might not have resulted. In various types of chronic renal disease enlargement of the parathyroid glands[9] occurs. When renal impairment is the cause of secondary parathyroid hyperplasia, usually three or four of the glands are enlarged. In this patient a solitary parathyroid adenoma was found at operation rather than diffuse hyperplasia. It is believed that the tuberculosis was not related to the parathyroid disorder. The diffuse calcification of the renal parenchyma which was present on the roentgenogram may have been due either to hyperparathyroidism or renal tuberculosis. Perhaps both were contributory in this patient.

Case VI. This patient was a thirty-one year old man. A case summary has been previously reported.[10] However, it is included here in order to emphasize the characteristic progression of symptoms. His chief complaint was that of "sore knees" which had been present for a year. He described the insidious onset of aching in both knees followed by aching in the elbows eight months later. These symptoms were continuous and progressive. One month before admission he was pushing a car and experienced severe pain over the left tibial tubercle. A week later the left leg suddenly became very weak and he fell to the ground. There was swelling of the knee and the patient reported that fluid was aspirated from the joint spaces by his physician. Subsequent studies revealed generalized skeletal demineralization, multiple bone cysts, fractures through cystic

areas in two ribs and nephrocalcinosis. A parathyroid adenoma was removed at operation and a fragment of the tumor was transplanted between the strap muscles of the neck. Two years later the patient returned with a recurrence of all manifestations of hyperparathyroidism and at operation a parathyroid adenoma was found at the site of the graft. Neither tumor was considered malignant on microscopic examination. Nearly two years later he again returned with recurrent symptoms and at this third operation the tumor was found at the site of the primary adenoma as well as at the site of the graft. The tumor invaded the thyroid gland, muscle and other soft tissues of the neck. Microscopic examination by pathologists revealed cellular changes compatible with a diagnosis of carcinoma of the parathyroid gland. No evidence of metastases have appeared to the present time.

Comment. The symptoms of this patient re-emphasize the importance of persistent skeletal pain as one of the earliest manifestations of the disease. Invasive or metastatic qualities of parathyroid tumors are rare.[12,13] When they do occur, the prognosis, of course, is poor.

Case vii. This was a twenty-four year old woman. Five months before admission she had mild transient aching of the left knee on weight-bearing. This subsided but a few weeks later aching in the right knee developed which, though mild, was persistently present on weight-bearing. Two weeks prior to admission she stepped from a curb on the right foot and had a severe pain in the right hip. She fell to the ground and was unable to get up. She was taken to a hospital where x-rays demonstrated a fracture through a cyst of the right femur. She was referred to the University Hospital two weeks after injury where an initial diagnosis of hyperparathyroidism was confirmed and a parathyroid tumor was removed at operation.

Comment. This patient had persistent aching in the lower extremities five months before a fracture was incurred. But again, diagnosis was not made until a fracture directed attention to the extremity.

Case viii. A fifty-three year old white female had the onset of her illness five years before admission. At that time she had suffered a spontaneous fracture of the left patella and she was told it was due to a "cyst." Internal fixation was performed and recovery was apparently uneventful. Four years later she began to have aching in the left knee and this was followed over a period of several weeks by the onset of persistent aching in the right knee, the hips, shoulders, elbows and hands. The pain was exaggerated by damp weather and exertion and relieved by salicylates. These symptoms were progressive and the right hip became quite painful on motion during the six months just prior to admission. There was progressive weakness and a weight loss of 30 pounds. A week before admission she became bedridden. On examination she had painful limitation of motion of all the above joints and an initial diagnosis of a mixed type of arthritis was made. However, subsequent studies revealed the probability of parathyroid hyperfunction. A parathyroid tumor was found imbedded in the left side of an adenomatous thyroid gland.

Comment. In this case there was a history of both a bone cyst and persistent pain in the extremities. The latter was so generalized and was in association with swelling, tenderness and pain on motion of multiple joints that it was confused with arthritis. The patient had advanced skeletal changes as evidenced by spontaneous fracture of humerus and femur while turning in bed during the postoperative period.

Case ix. This thirty year old man had an episode of renal colic at the age of eighteen. At twenty-three this recurred and retrograde pyelograms made by his physician revealed and dislodged a ureteral calculus. Four years before admission he began having symptoms of hypoglycemia and during a two-day period of unconsciousness a blood sugar was reported to have been 23 mg. per cent. Six months after his first hypoglycemic attack he had a laparotomy and an islet cell tumor was removed from the pancreas. Two months later he had a right nephrolithotomy. Two years prior to admission he was in an auto accident at which time he suffered a skull fracture with a resulting left hemiplegia. He had constant fatigue unrelieved by rest for many years but following

the accident it seemed to be more marked. A little less than a year had passed before he was again hospitalized at which time he had a right nephrectomy for calculus disease. Four months before admission he was placed on oral prostigmin for "spastic symptoms." During the month preceding his entrance to the University Hospital he had three episodes of occipital headache, marked weakness and fatigue, twitching of the left shoulder and arm, projectile vomiting and vertigo. The past history also revealed five fractures since the age of thirteen. All of them were due to considerable trauma, the last one occurring at the time of the auto accident.

Physical examination revealed a left frontoparietal skull defect and spastic paralysis of the left upper and lower extremities. No tumor could be palpated in the neck. No skeletal symptoms were present and the x-rays of the bones were negative. Repeated blood sugar tests and a glucose tolerance curve demonstrated the absence of hypoglycemia. Because of a persistently elevated calcium level and the operative loss of one kidney, exploration of the parathyroids was performed and an adenoma removed.

Comment. The history of the pancreatic tumor and injuries from the auto accident interjected into a long history of renal calculi was at first misleading. However, this case belongs in the category of parathyroid adenomas that have only renal symptoms. The fractures that this patient had all followed trauma of sufficient degree so that none of them could be termed spontaneous or pathologic fractures. The roentgenograms of the skeletal system failed to reveal any generalized demineralization or any bone cysts. There was no history of skeletal pain, tenderness or deformity. Only the kidneys had suffered from the parathyroid dysfunction and it would seem that the calcium-phosphorus imbalance could probably have been detected many years previously. Because it was not discovered, this patient has only one kidney at the age of thirty.

Case x. This forty-eight year old white man had his first symptom ten years prior to admission when he noted that his upper front teeth were loose. Following the administration of calcium, the teeth became firmly imbedded. Three years later he had symptoms of renal calculi which were subsequently relieved by the passage of four small stones. Twenty-one months prior to admission he had the onset of fatigue, weakness, malaise and drowsiness. At this time he began having muscle and bone pain of both thighs. These symptoms were ascribed to badly infected teeth and the latter were extracted five months later. Because of difficulty in the fitting of dentures he consulted an oral surgeon who discovered a right maxillary tumor. This was removed and the pathologic study revealed it to be a giant cell tumor. The pain in the lower extremities was somewhat relieved following the removal of the tumor but a year later recurred and was persistent. The latter became so severe in the following months that crutches were employed until finally he became completely bedridden. Two months before admission, while holding a quart jar of water, he suffered a fracture of the right humerus and one month later, while testing the strength in his hand, an extensor tendon was avulsed from its insertion. Also during this latter period his ribs became tender and swollen.

On examination the significant physical findings were a non-tender, soft mass approximately 1½ by 2½ cm. in the lateral aspect of the left lobe of the thyroid, marked dorsal kyphosis, palpable deformity of the right humerus and right radius, and bilateral costovertebral tenderness. The x-ray and laboratory studies confirmed the diagnosis and a parathyroid tumor was removed. This patient developed an uncontrolled hypoparathyroid state postoperatively and died on his twentieth postoperative day of intercurrent infection.

Comment. This patient's prolonged illness and subsequent death would probably have been avoided if the disease had been recognized at one of several points in its course. The passage of renal calculi should have suggested hyperparathyroidism. Later the symptoms of hypotonia and persistent skeletal pain were a basis for suspicion. More recently, the removal of a giant cell tumor of the maxilla was further evidence of possible parathyroid hyperfunction. The spontaneous fracture which occurred was in an area of a bone cyst and a second

fracture occurred in the left femur during the postoperative period.

COMMENTS

The most important symptoms for early recognition of this disease are recorded in Table I.

TABLE I
INITIAL SIGNIFICANT SYMPTOMS IN HYPERPARATHYROIDISM

Case	Initial Significant Symptom	Interval between First Symptom and Diagnosis
I	Painful, swollen ankles	3 yr.
II	Renal colic, hematuria, passage of calculi	1½ yr.
III	Giant cell tumor, right maxilla	10 mo.
IV	Persistent dull pain, left hip	2½ yr.
V	Fatigue and weakness; persistent aching pain in all extremities	2 yr.
VI	Persistent aching pain of knees and elbows	1 yr.
VII	Persistent aching pain of right knee	4 mo.
VIII	Spontaneous fracture of left patella through a bone cyst	5 yr.
IX	Renal colic	12 yr.
X	Renal colic; passage of calculi	7 yr.

TABLE II
HYPERPARATHYROIDISM—SKELETAL STATUS

Case	Pain and Tenderness of Muscles and Joints*	Swelling of Joints*	Deformity*	Skeletal demineralization	Bone Cysts	Fracture	Anemia
I	+	+	+	+	0	0	+
II	+	0	+	+	+	0	0
III	+	0	+	+	+	+	+
IV	+	0	0	+	+	+	+
V	+	0	0	+	+	+	+
VI	+	+	+	+	+	0	0
VII	+	0	0	+	+	+	0
VIII	+	+	+	+	+	+	+
IX	0	0	0	0	0	+†	0
X	+	+	+	+	+	+	0
Total	9	4	6	9	8	7	5

* Symptoms *not* associated with fracture.
† Severe trauma.

Skeletal pain and tenderness was present in all but one of these cases (Table II) and in five of them it was the initial symptom. The pain was usually described as an aching type of pain in the lower extremities but was occasionally present in the upper extremities and back. In two cases pain was associated with weight-bearing. It should be especially emphasized that though the pain was not incapacitating in the early phases, it was *persistent*. Thus, the complaint of persistent aching pain in the extremities is very important in recognizing the early stages of the skeletal type of hyperparathyroidism.

Renal calculi have long been a criterion for suspicion of hyperparathyroidism. Cope[4] has shown that parathyroid hyperfunction frequently produces renal calculi without producing skeletal changes. In three of our patients the initial symptoms of the disease were those of renal calculi and in Case IX these were the only symptoms for nearly twelve years. One other patient with renal calculi had no symptoms referable to this. Three other patients had nephrocalcinosis without stones in the calyces or pelvis. (Table III.) In Case X only microscopic nephrocalcinosis was present.

Spontaneous fracture occurred as an initial symptom in only the one case but it occurred five years before the diagnosis of hyperparathyroidism was made and it was known that the fracture occurred through a bone cyst. Six other patients had suffered one or more fractures through cystic areas at variable periods before admission. (Table II.)

Tumor of the maxilla was the first symptom to occur in one case (Table I) though another patient had this deformity appear during the undiagnosed course of the disease. (Table II.) Osteoclastomas of the maxilla or mandible, as in these two cases, may be reported by the pathologist as giant cell tumors. Osteoclastomas are not uncommonly a manifestation of hyperparathyroidism.[1,2]

Hypotonia. That hypercalcemia results in muscular weakness, ease of fatigue, constipation and other gastrointestinal disturbances has been known for many years. These symptoms cannot be considered of

great diagnostic import although they have a real physiologic basis. If such symptoms appear in a formerly active person, the possibility of hyperparathyroidism should not be wholly forgotten. In Case v fatigue and weakness were the initial symptoms and all but one patient complained of some manifestation of hypotonia for long periods in the course of the disease. (Table IV.)

Secondary anemia may result because of a proliferation of the reticular cells of the bone marrow which replaces the hematopoietic elements.[1] This was present in five cases. (Table II.)

TABLE III
HYPERPARATHYROIDISM—RENAL STATUS

Case	Symptoms of Calculi	Nocturia, Polyuria	Nephrolithias	Nephrocalcinosis	Decreased Renal Function	Infection	Sulkowitch Test
I	o	+	o	o	+	o	
II	+	o	+	o	++	+	
III	o	o	o	+	.....	+	
IV	o	o	o	o	.....	o	
V	o	+	o	+	++	+	
VI	o	+	o	+	++	+	++++
VII	o	o	o	+	.....	o	++++
VIII	o	+	o	o	++++	o	++++
IX	+	o	+	o	++	o	Negative
X	+	o	+	o	+++	o	+++
Totals	3	4	3	4	7	4	4

TABLE IV
HYPERPARATHYROIDISM—EVIDENCES OF HYPOTONIA

Case	Lassitude, Weakness	Weight Loss	Gastrointestinal Disturbances	Objective Signs of Hypotonia
I	+	+	+	+
II	o	o	o	?
III	+	+	+	?
IV	+	+	+	?
V	+	?	+	+
VI	+	+	+	+
VII	+	+	o	+
VIII	+	+	+	?
IX	+	o	+	?
X	+	+	o	+
Totals	9	7	7	5

BLOOD CHEMISTRY

A discussion of early diagnosis in hyperparathyroidism would not be complete without denoting the variation in calcium and phosphorus levels. It has been repeatedly demonstrated that calcium levels are not necessarily markedly elevated in the disease, especially in the early phases.[1] Two of our patients had only slight elevation of the serum calcium. (Table V.) In Case I levels varied from 12.0 to 13.0 mg. per cent and in Case IV levels varied from 11.3 to 12.1 mg. per cent. A single determination which is borderline does not rule out

TABLE V
HYPERPARATHYROIDISM—BLOOD CHEMISTRY

Case	Calcium (mg. per cent)		Phosphorus (mg. per cent)		Alkaline Phosphatase (Bodansky U.)	
	Min.	Max.	Min.	Max.	Min.	Max.
I	12.0	13.0	2.2	3.2		
II	....	15.7	...	3.6	....	4.5
III	....	16.4	...	3.8		
IV	11.3	12.1	2.5	2.9	13.3	14.8
V	15.4	16.1	2.9	3.1	....	9.4
VI	....	15.8	....	4.0	....	19.5
VII	14.4	16.1	2.5	2.9	16.9	18.8
VIII	13.4	13.8	4.0	4.1	4.3	9.7
IX	12.0	13.9	2.4	2.8	3.9	7.6
X	....	14.1	....	4.0	....	10.0

hyperparathyroidism; when the symptoms so indicate, several determinations should be made. Serum protein determinations should always be included as one of the routine laboratory studies when hyperparathyroidism is suspected. If the serum proteins are low, a normal value for calcium may indicate hyperparathyroidism.[4]

Phosphorus levels will be relatively low unless renal insufficiency results in phosphate retention.[8] The many normal or slightly elevated values recorded in Table v can be accounted for on the basis of decreased renal function.

Alkaline phosphatase levels are of diagnostic value only if skeletal disease is advanced. Albright[1] is of the opinion that this determination is an index of osteoblastic activity.

SUMMARY

The case histories of ten patients who have had the diagnosis of hyperparathyroidism confirmed by surgical removal of a parathyroid adenoma have been reviewed. From these cases it is apparent that an early diagnosis of this entity requires that the physician become "parathyroid conscious." The earliest symptoms may be wholly related to the skeletal system, to the muscular system or to the renal system without striking overlap. A positive diagnosis made early in the patient's disease will prevent most of the crippling sequelae of long-standing hyperparathyroidism.

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WOUNDS OF THE HEART AND PERICARDIUM*

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THE treatment of wounds of the heart and pericardium has changed considerably from the days when cardiac surgery was considered hopeless and heroic to the present when reports of operative interference are no longer rare. The mortality rate has been greatly reduced, due in no small part to the more frequent diagnosis of wounds of the heart and pericardium. Perforations of the heart such as the type caused by bullets and lacerations of the intrapericardial vessels will result in rapid exitus before effective therapy can be instituted. Our findings, as well as those in the literature, indicate that when the patient arrives at the hospital alive, no matter how critically ill, he may be saved. We are presenting, herein, four cases of stab wounds of the chest with pericardial and myocardial involvement, of which three were treated conservatively and one was treated by surgery. The electrocardiogram played an important part in the early diagnosis of these cases.

DIAGNOSIS

Significance of Early ECG's. Much has been written previously about the diagnosis of penetrating wounds of the heart and pericardium. Anyone receiving a lacerating wound over the precordial region must be suspected of having sustained cardiac trauma. This is especially true when the symptoms of shock are out of all proportion to the amount of blood lost[1] and when a hemopneumothorax has been excluded. In the presence of hemothorax, the possibility of a wound which has pierced both pericardium and pleura with bleeding from one cavity into the other must be borne in mind.

Griswold and Maguire[1] mention Beck's triad of acute cardiac compression: (1) falling arterial pressure; (2) rising venous pressure and (3) small, quiet heart. These, together with the physical findings of rapid, paradoxical pulse, low pulse pressure, distention of venous circulation and distant, muffled heart sounds speak of tamponade. Fluoroscopy in doubtful cases bears out the fact that cardiac activity is reduced, and may further demonstrate intrapericardial fluid. X-ray, on the other hand, is not necessarily of much help[2] since it will usually show no abnormality of heart size inasmuch as only 100 to 200 cc. of blood will cause tamponade.

These patients are usually in such deep shock that they appear to be in extremis. It is difficult then to move them around for adequate fluoroscopic and roentgenologic examination. We have found the electrocardiogram of great help in verifying early the presence of injury to the heart and pericardium by changes indicative of pericarditis, hemopericardium or myocardial injury. In addition to the three standard leads, augmented unipolar extremity leads and multiple unipolar precordial leads[3,25] were taken because it has been shown that these are of value in detecting evidence of myocardial injury when the standard leads are normal. The augmented unipolar leads were taken from the left arm (left arm lead), the right arm (right arm lead) and the left leg (left leg lead). The multiple precordial leads were taken as follows: lead V_1, precordial electrode on the fourth intercostal space just to the right of the sternum; lead V_2 precordial electrode on the fourth interspace just to the left of the sternum; lead V_3

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mid-way between leads V_2 and V_4 which is the precordial electrode on the fifth intercostal space at the left of the mid-clavicular line; lead V_5, electrode on the left anterior axillary line at the level of V_4; lead V_6, electrode on the left mid-axillary line at the level of the lead V_4.

Many investigators have pointed out[4,5,6] that pericardial effusion in itself does not cause electrocardiographic changes, and the presence of changes in the RS-T segments and T waves is a sign of injury to the superficial layer of the myocardium just beneath the pericardium. In cases of penetrating wounds of the heart the presence of RS-T and T changes, however, does not necessarily indicate that the heart muscle itself has been injured by trauma because a pericardial effusion or a hemopericardium can serve to irritate the superficial layers of the heart. The deep wide abnormal Q waves that occur after myocardial infarction do not appear after penetrating wounds of the heart unless one of the larger coronary arteries is severed as a result of the accident. Solovay, Rice and Solovay[7] point out that weeks or months after operation T wave changes become more pronounced and then revert to normal.

MANAGEMENT

In the past there has been considerable divergence of opinion as to the management of these cases. Bigger predicates the type of treatment on the nature of the injury. In 1932[8] he divided his cases into three classifications: (1) Pericardial injury alone or pericardial and heart injury without penetration into a chamber division or coronary vessels. These may be treated conservatively; (2) penetration into a chamber or coronary vessel division. Operation is usually indicated; (3) severe injuries with immediate death.

In 1939 Bigger[9] divided his cases into four groups and treated them accordingly: (1) Free communication between the pericardium and pleura but only slight or moderate hemorrhage. These are treated conservatively. (2) Tamponade present, but following venoclysis, adrenalin and other supportive measures there is marked improvement. A cannula is placed in the pericardial cavity and blood withdrawn. If after fifteen or twenty minutes there is no evidence of further bleeding, conservative therapy is continued. In the interim all preparations for operation are made. (3) Greatly increased pericardial pressure with no satisfactory response to conservative therapy. These are explored. (4) Free communication between pleura and pericardium with massive intrapleural hemorrhage. Immediate operation is performed and blood from the pericardial cavity is reinfused. He further points out that chance of recovery without exploration is slight when the wound has penetrated the heart.

Schiebel[11] apparently believes that all heart wounds should be explored since a healed wound may cause rupture or aneurysm when no surgical repair is performed.

Nelson,[12] in reporting a series of cases in 1943 from Charity Hospital, New Orleans, states that he believes patients with stab wounds of the heart should be explored. In certain cases the extent of injury is not immediately apparent and death may occur before surgery can be performed. He further states that patients who are brought out of shock and then relapse under conservative treatment are not apt to recover. Moreover, exploratory operation has little risk attached. He adds that the possibility of aneurysm formation and later pericardial adhesions cannot be ignored, and that aspiration of the pericardial sac is attended by the risk of puncture of a coronary vessel. From 1906 to 1943 there were twenty-seven cardiorrhapies at Charity, and better results later in the series are attributed to more frequent exploration.

Blau[13] reports a series of twenty-seven penetrating wounds of the heart at the Detroit Receiving Hospital; twenty-one were operated on with a mortality of 23.8

per cent. Of the six remaining cases, three were observed and three were aspirated. In the whole series of twenty-seven cases there were six deaths, five in the operated group and one in the conservatively treated group, with a total mortality of 22.2 per cent. Blau also refers to a case reported by Vance in which death occurred eight days after the wound due to the wound edges being forced apart, with fatal tamponade resulting. He also refers to an article by Long in which Long states that the spontaneous closure of the parietal pericardium may result with a blood clot when the blood pressure is low, changing of relative openings of the myocardium and the pericardium as the hemopericardium increases, a small puncture wound of the pericardium over a large heart wound, or non-penetration of either pleural cavity.

Bigger[9] reported seventeen cases at the Medical College of Virginia Hospital. In twelve of these there were simple penetrating wounds of the heart cavities or lumina of the intrapericardial portions of the great vessels, and of these eight recovered and four died. A patient with a heart wound is put in Trendelenburg position, given morphine sulfate and atropine, and, if in collapse, 5 m. of adrenalin subcutaneously and 10 to 15 m. by vein. When there is no sign of tamponade, conservatism is practiced. In the past all patients with tamponade and signs of heart injury with massive or moderate hemothorax were operated on, but now operation is performed only when marked signs of tamponade persist or when the indications are clear. Otherwise treatment is conservative. He cites the case of a twenty-two year old patient with a bullet wound of the chest who, despite the fact that he had blood and air in the pericardium, had no tamponade. He was given supportive treatment and recovered. He cited another case of a patient who at operation had a clot attached to the anterior heart wall over one of the divided branches of the left descending coronary artery. This patient recovered without ligature of the artery. Obviously, he adds, aspiration would have sufficed.

Strieder[14] reports the case of a twelve year old boy with a stab wound of the heart. Because of evidence of tamponade he was prepared for operation. But when a No. 16 gauge needle was introduced into the pericardial sac and 100 cc. of blood were obtained and reinfused into his vein, dramatic improvement and eventual complete recovery resulted without operation. The author adds, however, that the danger of aneurysm of the heart and coronary vessels is great so that non-operation in a case of this type is hazardous.

Griswold and Maguire[1] report forty-seven cases of diagnosed heart wounds treated at Louisville City Hospital in an eight-year period. Of these, seven were misdiagnosed and turned out to be pathological conditions of organs other than the heart. Thirteen died less than twenty minutes after admission to the hospital. Of the twenty-seven patients who lived longer than twenty minutes after admission, twenty-two were operated on with six deaths during or following the operation; five patients were treated conservatively with one death. Mortality for the twenty-seven cases was 25.9 per cent.

Elkin[2] reported thirty-eight cases operated upon for heart wounds, of whom twenty-two recovered without sequelae. He believes that operation should be carried out as soon as a heart wound is diagnosed. Three years later[10] he reported a series of twenty-three cases with eighteen recoveries. While in his first series infection played a large part in causing death, in the latter group this complication was not present due to more meticulous operative technic. He concurs with Bigger and Blalock that where there is no immediate urgency for operation and aspiration results in continued relief, conservatism may be practiced.

In the Military Surgical Manual on neurosurgery and thoracic surgery[16] it is stated that frequently these patients will respond to conservative treatment, as a

small heart wound may be sealed off during circulatory collapse. Pericardiocentesis is recommended when tamponade and hemothorax are not coexistent. When there is a reduction in venous pressure and arterial pressure is maintained, it may be assumed that bleeding has ceased and conservative treatment is to be continued.

Blalock and Ravitch[17] quote Felsenreich as saying that the treatment of penetrating ventricular wounds should be operative, while auricular wounds may be handled conservatively because of the likelihood of cessation of auricular bleeding. But other writers have stated that because of its lack of contractility and elasticity, wounds of the auricles are more apt to be followed by fatal consequences. They bring up the problem as to whether the end results may not be better if a more conservative policy is instituted, and believe that operation may be delayed if symptoms are due to tamponade and not to continued bleeding. They qualify this with saying that probably not more than two hours should elapse with continued tamponade and, if blood reaccumulates, pericardiotomy is indicated.

Glasser, Mersheimer and Shiner[18] quote Kosmin as saying that isolated pericardial injuries are much more rare than heart injury, occurring in the ratio of 1:10, conceivably because of heart activity, nature of the weapon and degree and direction of penetration. They quote Gunzling and Sarkisov as saying that the signs of isolated pericardial injury will be hemorrhage from the wound, dyspnea and increased cardiac dullness to percussion, but clear heart sounds with only temporary or insignificant signs of tamponade will also be present.

PATHOLOGICAL PHYSIOLOGY

The wound is most commonly caused by a knife or an ice pick, less commonly by a bullet; this is statistically borne out in all large series. In gunshot wounds, because of the destructive nature of the injury and because there is perforation of the heart, rapid exsanguination and death occur so that these patients rarely come to operation. Schiebel[11] states that bleeding, when it occurs, is into the relatively inelastic pericardial sac, and the wound is frequently plugged by overlying muscle. The intrapericardial pressure rises and there is increasing pressure on the chambers of the heart as bleeding continues. As pressure in the right auricle rises, there is a decrease in cardiac intake and output, and cerebral anemia is rapidly followed by death.

It would seem reasonable to assume that where there is intrapericardial bleeding with increased atrial and venous pressure and decreased cardiac output, intravenous fluids would do little to alleviate the state of embarrassed circulation and peripheral shock. Though the trauma to the heart is severe, unless there has been extensive external hemorrhage or bleeding into the thorax, the presenting picture is one of collapse due to tamponade, diminished cardiac output and cerebral anemia. In fact, according to Elkin,[15] "a symptomless interval . . . during the time the pericardium fills with blood, is the most important point in the history." Typically the onset of symptoms dates back to a state of tamponade. Beck[19] believes that intravenous fluids cause a rise in arterial pressure if there is a fixed state of cardiac compression and some of the blood can escape from the pericardial cavity. Ward and Parker[20] believe that one must differentiate between symptoms due to shock of hemorrhage or tamponade. However, they conclude that intravenous infusions rarely do harm and may be livesaving.

The work of Cooper, Stead and Warren, in 1944, and later papers published by them and Merrill and Brannon[21–24] have shown the beneficial effects of supportive intravenous therapy in these patients. They said that as the venous pressure goes up its effect is to overcome the block occasioned by the increasing auricular pressure. The amount of blood entering the veins is limited by the diminishing cardiac output, and increasing the blood volume

will increase the venous pressure and help combat tamponade. In their experiments on dogs they found that animals could survive 100 per cent more of increased intrapericardial pressure than before if given intravenous fluids. There was also an associated rise in arterial pressure. They concluded:[21] "In patients who survive until they reach the hospital the myocardial, and probably the pericardial rents are at least temporarily closed . . . it is possible that, in certain selected patients, raising the venous pressure by increasing the blood volume will restore the circulation to an adequate level without aspiration or operation."

In 1946 Brannon, Stead, Warren and Merrill[23,24] reported that when blood volume in humans was raised with intravenous fluids there was increased cardiac output and arterial pressure while the peripheral resistance dropped. They added, significantly, that patients who have suffered trauma may react with reflex vasodilation and present signs of circulatory collapse. These same men[24] studied four patients with stab wounds of the heart and found that the situation was different from chest wounds and hemorrhagic shock. They found the atrial pressure elevated, the arterial pulse paradoxical, cardiac output decreased and peripheral resistance up. When two of these were given intravenous albumin, there occurred a rise in atrial pressure, cardiac output and arterial pressure, improved oxygenation function of the blood stream and a diminished degree of paradoxical pulse as measured in the femoral artery. They state that where the circulation improves promptly without therapy, the main factor is probably one of reflex vasodilatation and not tamponade; but where failure persists until the intrapericardial pressure is lowered, it must be due to tamponade. Raising the venous pressure by intravenous fluids will not improve the circulation unless the pericardium will distend in diastole and permit the heart to receive more blood, or unless blood is being forced out of the sac.

That some part of the symptomatology complex of patients who suffer a penetrating wound of the pericardium and heart is due to reflex vasodilatation is a theory that seems attractive to us. Certainly, supportive treatment without aspiration has done nothing to remove whatever fluid is present to cause the tamponade, yet some of these patients will recover without residual signs of cardiac embarrassment. This has been so in three of our four cases presented.

CASE REPORTS

With the foregoing remarks and especially with the important experimental studies of the last mentioned investigators in mind, the following cases are presented:

Case 1. E. J., a sixteen year old colored male, was admitted to the hospital May 14, 1946, with a history of having been stabbed in the left chest a short time before admission. Physical examination revealed a well nourished and well developed male in deep shock. The skin was cold, clammy and pallid; the pulse was rapid and weak; the blood pressure unobtainable and temperature was 95.6°F. There was a puncture wound in the fourth interspace 1 inch medial to the left nipple line. Heart sounds were distant, weak and rapid. Breath sounds were rapid and shallow, but examination of the lungs failed to reveal hyperresonance, dullness or flatness.

The patient was immediately given 500 cc. of plasma followed by 500 cc. of blood and then 1,000 cc. of 5 per cent glucose in saline. Within one hour he showed definite evidence of coming out of shock, began to talk coherently and the pulse became full and regular. He continued to show improvement and on the following day his only complaint was localized pain over the wound site. The temperature curve remained in the region of 101°F. for eight days and then returned to normal. He was discharged eleven days after admission without complaint.

X-rays taken within eight hours of admission and five days later are herein reproduced. The x-ray taken on May 14th indicated fluid in the left lower lung field. This was again noted on May 19th, when the heart shadow was grossly enlarged with C-T ratio of 12/23.5. Five

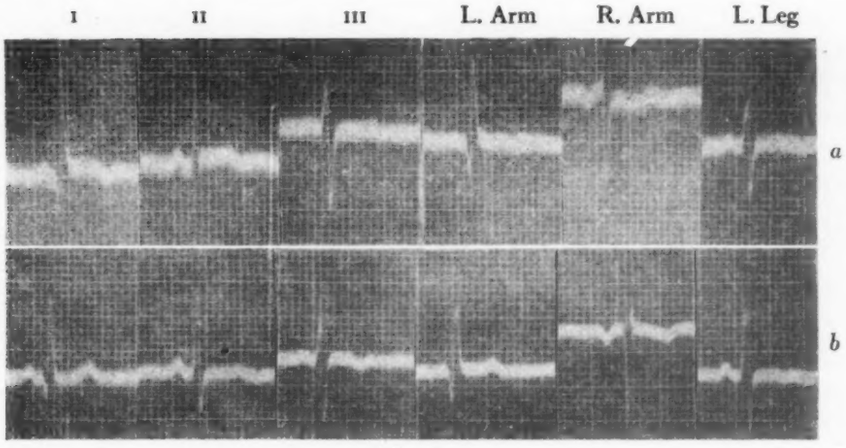

Fig. 1A

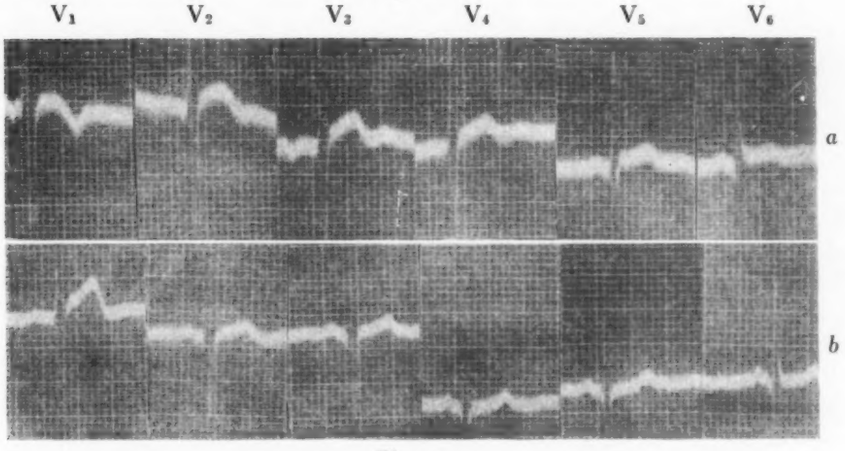

Fig. 1B

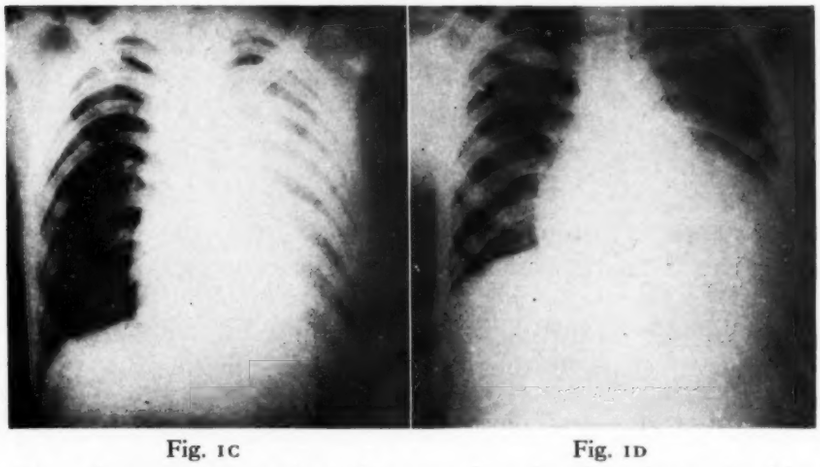

Fig. 1C

Fig. 1D

FIG. 1. Case I, A and B, tracings taken seven days after the stab wound and five months later. The upper rows (*a*) reveal the following: The standard leads I and II show abnormal elevation of the RS-T segments. This can also be seen in the precordial leads V_5 and V_6. This indicates that the stab wound had caused (directly or indirectly by means of a hemopericardium) myocardial injury. The lower tracings (*b*) are normal. C, May 14, 1946, bedside chest film showing diffuse clouding over the left lower lung field suggesting fluid. The heart does not appear unusual. D, on May 19, 1946, there was diffuse clouding of the left lower lung field with increased pulmonary markings, suggestive of fluid with underlying consolidation. The heart was now grossly enlarged, C/T ratio 13/23.5, which suggested pericardial effusion.

months later the heart and lungs were essentially normal. Electrocardiographic findings are recorded (Fig. 1) and show evidence of hemopericardium or myocardial injury. Tracings five months later are normal. Laboratory studies of the blood, urine and serology were all negative. Venous pressure, taken in September, was 100 mm. of water. The circulation time was normal.

Note that there was early x-ray evidence of fluid in the left lung field, and this was probably a communication between pleura and pericardium. Because the patient was comfortable, out of shock and without evidence of continued bleeding, exploration was not undertaken.

The location of the wound, clinical findings and the electrocardiogram provide proof of intrapericardial injury.

Case II. A. D., a twenty-five year old colored male, was admitted to the ward on August 11, 1946, with a history of having been stabbed in the chest with a knife. On examination he was comatose, skin cold and clammy, pulse rapid and weak, respirations rapid and shallow, blood pressure 50/0. There was a 1 inch lacerating wound one inch from the sternal margin in the left fourth interspace, still oozing a small trickle of blood. Heart sounds were regular and distant at 140 per minute; examination of the lungs was negative.

The patient was given 500 cc. of plasma with 5 cc. of coramine intravenously and placed in an oxygen tent. This was followed with 500 cc. of whole blood and 1,000 cc. of 5 per cent glucose in saline. Within two hours he began to react favorably. He became coherent in his speech; his pulse became stronger and blood pressure rose to 74/36. Examination of the heart failed to reveal evidence of tamponade or cardiac shift. Ten hours following admission the blood pressure was 120/80 pulse rate 120 per minute; respiration 20 per minute. On the following day he had no complaint other than mild tenderness over the region of the wound. Fluoroscopy two days later showed diminished intensity of expansion of the right side of the heart, findings consistent with the presence of a small amount of fluid in the pericardium. His temperature rose to 102.8°F. twenty-four hours after admission but thereafter he ran an afebrile course. He was discharged asymptomatic fifteen days after admission.

On August 14th an upright film showed an enlargement of the heart to the right and to the left, and on August 22nd a teleroentgenogram was suggestive of pericardial fluid. The electrocardiogram (Fig. 2) shows evidence of myocardial injury up to five weeks after the stab wound. On August 15th the venous pressure was 120 mm. of water; arm to tongue circulation time was 23 seconds; arm to lung circulation time was 10 seconds. Note that the circulation times are definitely prolonged. Other laboratory findings were negative.

Electrocardiograms, fluoroscopic examination, clinical findings and location of the wound support a diagnosis of penetrating heart injury in this patient.

Case III. F. P., a fifty-one year old, colored male, was admitted to the ward with a transverse laceration in the fourth interspace on the left, approximately 2 inches from the sternal border. There was blood oozing from the wound. He was comatose; his skin was cold and clammy, blood pressure was 60/20, heart sounds were distant and rapid. The rest of the physical examination was essentially negative.

The patient was immediately placed on intravenous fluids which included 1,000 cc. of 5 per cent glucose in saline, 500 cc. of plasma and 500 cc. of whole blood, and he was placed in an oxygen tent. Within an hour he showed considerable improvement; his speech was coherent; his skin was warm and his blood pressure rising. Eight hours later he was quite comfortable.

On three occasions during his period of convalescence he complained of severe pain in the left chest which responded to mild sedation. Examination of the heart during these periods was negative. The patient was discharged from the hospital asymptomatic fourteen days after admission.

Fluoroscopy performed on August 14th showed normal contour of the heart on the left, with moderately diminished pulsation at the right lower border with obliteration of the normal cardiophrenic angle suggestive of a small amount of pericardial fluid. The electrocardiogram (Fig. 3) was normal five days after the stab wound. However, two weeks later there was evidence of myocardial injury and two months later the tracings were once more normal. On admission a portable chest plate was not remarkable. On August 12th there was reported to be a bulge in the wall of the left ventricle consistent with post-traumatic aneurysm and some diminution of illumination

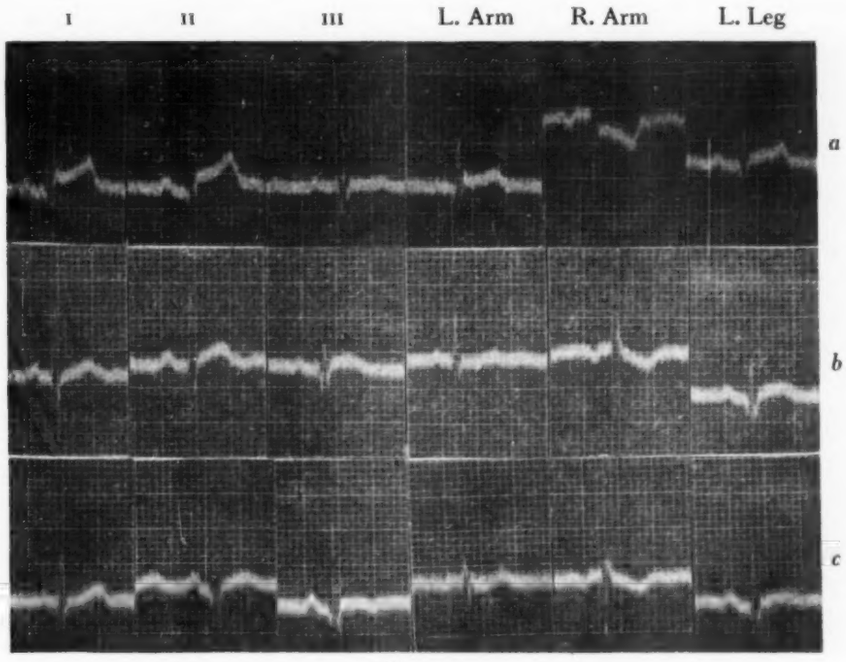

Fig. 2A

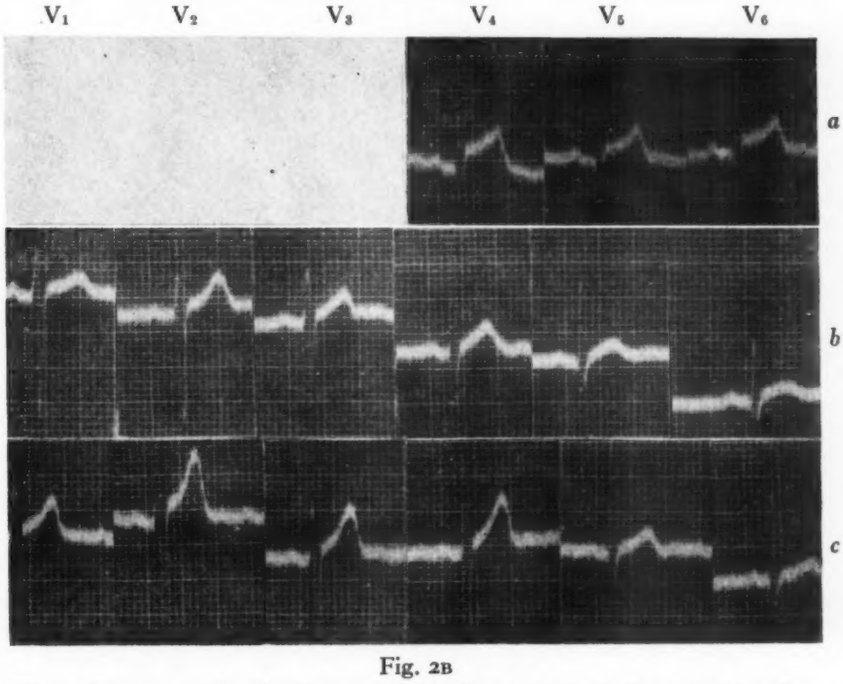

Fig. 2B

FIG. 2. Case II, A and B, the upper rows (*a*) of tracings were taken two days after the stab wound. The middle rows (*b*) were taken twelve days after the stab wound, and the lower rows (*c*) were taken five weeks after the stab wound was inflicted. The upper rows show the following: only precordial leads V_4 and V_6 were taken because a dressing lay over the remainder of the chest. Marked and abnormal elevation of the RS-T segments of these leads were present. This indicated that the stab wound had resulted in myocardial injury. This was further confirmed by the elevated RS-T segments in leads I, II, L. Arm and L. Leg. The middle rows show the following: with the exception of lead V_6, the precordial leads are normal. The standards leads also appear normal but the L. Leg lead shows an abnormal elevation of the RS-T segment. The lower rows show the following: all the precordial leads are normal. The standard leads are also normal but signs of myocardial injury still are present in the L. Leg lead.

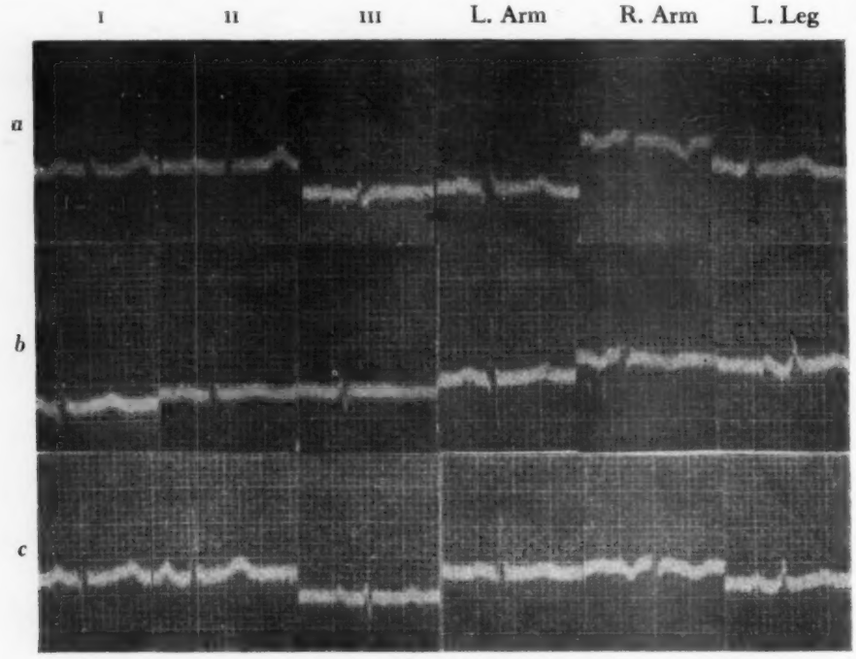

Fig. 3A

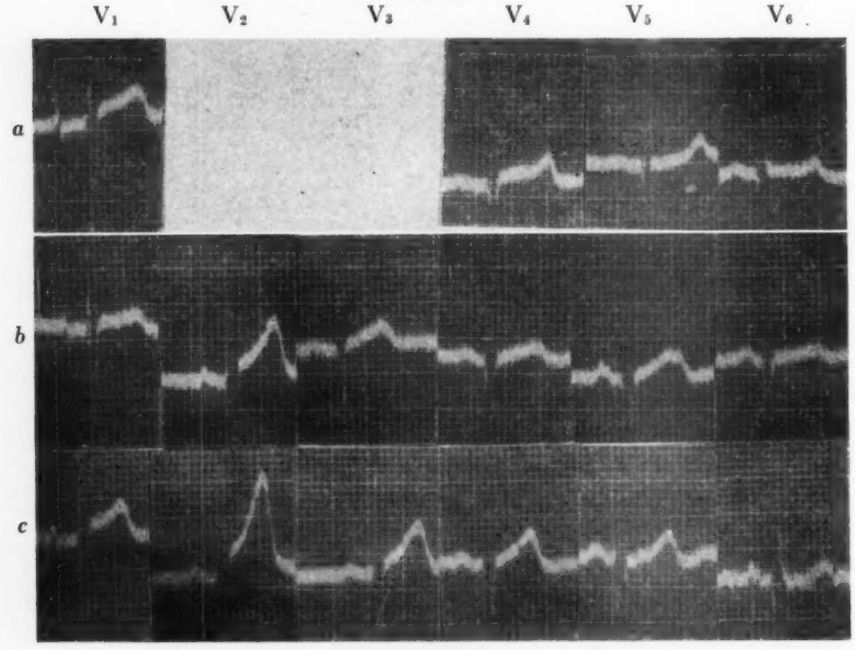

Fig. 3B

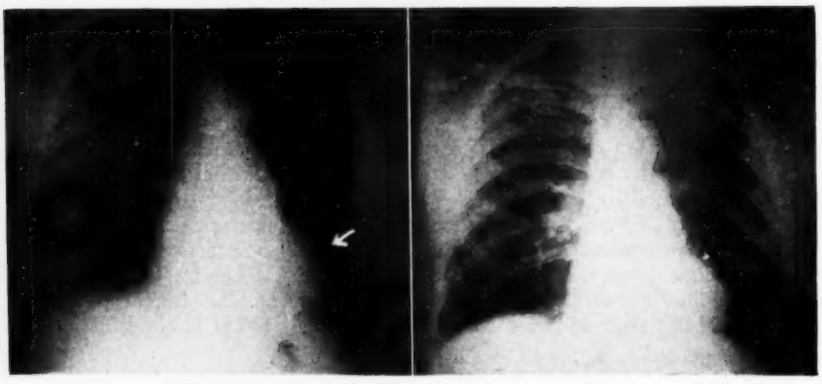

Fig. 3C Fig. 3D

Fig. 3. For descriptive legend see opposite page.

in the left lower lung field. Calcification in the walls of the descending aorta would indicate that there might well be an antecedent history of arteriosclerotic heart disease in this patient. Venous pressure reading on the day after admission was 95 mm. of water, with arm to lung circulation time of 10 seconds and arm to tongue circulation time of 25 seconds. One month later the venous pressure was still normal; arm to lung time was 11 seconds and arm to tongue time was 20 seconds. These are considered retarded. Other than positive Kline and Wassermann tests, blood chemistries and hematologic study were normal. Figure 3D, taken two months later, shows the heart to be smaller.

Here again, the clinical findings and the electrocardiogram aided in making the diagnosis of stab wound of the heart.

Class IV. E. C., a twenty-one year old white female, was admitted to the ward with a history of having stabbed herself two hours before admission while drunk. Physical examination revealed a well developed and well nourished white female, conscious and oriented, with cold, pallid skin and blood pressure of 55/32. There was a lacerating wound in the third left interspace, 3/8 of an inch long, located 1/2 inch from the midline. Respirations were rapid and shallow and examination of the chest revealed hyperresonance to percussion note above the region of the fourth interspace with dullness below that level, while heart sounds were muffled and distant. There were no breath sounds to be heard over the entire left chest.

The patient was immediately started on 1,000 cc. of 5 per cent glucose in saline and then switched to plasma. A chest tap in the fifth interspace left mid-axillary line was unsuccessful, with only 12 cc. of blood withdrawn. Four hours after admission she appeared much more comfortable, with the pulse stronger at 110 per minute; respirations smooth and regular at 30 per minute, and the skin warm and its color improved. Twelve hours after admission, however, it was noted that she was bleeding actively from her chest wound, and immediate exploration was deemed advisable. A laceration of the left auricular appendage of the heart was repaired at this time, 300 cc. of blood removed from the left pleural cavity and the patient was returned to the ward. Postoperatively she developed an empyema of the chest which responded to aspiration and supportive blood transfusions. The patient was discharged from the hospital thirty-six days after admission, relatively asymptomatic.

This patient was observed for a period of twelve hours before exploration was decided upon and the lacerated myocardium sutured. This may be accepted as further evidence that wounds of the auricles are less apt to be followed by the degree of rapid and massive bleeding characterizing lacerations of the ventricles and conservative therapy, while not advocated for this case, is apt to maintain the patient over a longer period of time. When there is communication between pleura and pericardium with evidence of continued bleeding, conservatism cannot be maintained for long and exploration becomes mandatory.

Though the essentials of treatment in the first three cases were supportive only, in the giving of oxygen, plasma, blood and isotonic fluids with stimulants when necessary, this is not presented as an argument for the non-operative handling of all wounds of the heart. When the hazards of operation, the chances of pericarditis with or without empyema, coronary occlusion

Fig. 3. Case III, A and B, the upper rows (*a*) of tracings were taken five days after the stab wound. The middle rows (*b*) were taken two weeks after the stab wound and the lower rows (*c*) of tracings were taken two months after the stabbing. The upper rows show the following: no abnormalities are present. Precordial leads V_2 and V_3 were not taken because this area was covered by the dressing over the stab wound. The middle rows show the following: standard leads appear normal but precordial lead V_6 and the L. Leg lead show abnormal RS-T segments and T waves indicating that myocardial injury is present. The lower rows are normal again. C, August 12, 1946, portable chest film shows some haziness in lower left lung field. A bulge in the left ventricular wall, consistent with post-traumatic aneurysm, was present. Calcification of the aortic arch and descending aorta were also noted. D, Two months later 6 foot film shows slight haziness in both lower lung fields.

with myocardial infarction, hemothorax and pneumothorax, pneumonia, embolism and atelectasis are considered, operation is not lightly undertaken and definite indications for it should be present. On the other hand, when it is remembered that non-operation may result in aneurysm of the heart or coronary vessels, or that at some time a clot may give way and sudden death occur, or that recurrent tamponade may cause death of cardiac failure and cerebral anemia, there should be no hesitancy in undertaking operation when the issue remains in doubt. Blau[13] quotes Dshanelidze as having proven that few cases have sequelae after operation. He collected 535 cases from the literature and in 96.5 per cent of 113 of these, who were followed for a number of years up to eighteen, there was no impairment of cardiac function. It would seem to us that the most satisfactory course, when conservative therapy has been decided upon, would be to have the operating room in readiness for immediate use should it become apparent that conservative measures have been to no avail.

CONCLUSIONS

1. In the presence of a stab wound, or other penetrating injury of the chest in the region of the heart, the electrocardiogram is useful in determining whether the pericardial cavity has been entered. Where there has been myocardial damage, the tracings will be of immediate diagnostic significance, and in pericardial damage the findings will be those of pericarditis and hemopericardium.

2. The use of unipolar extremity leads and multipolar precordial leads will help make the diagnosis of myocardial injury even when the standard leads are normal.

3. Signs of myocardial injury may remain in the unipolar extremity leads or multiple precordial leads even when the standard leads have returned to normal.

4. There are stab wounds of the heart that will respond to intravenous fluids, oxygen and stimulants. Among these are included simple pericardial injuries and cases which in some manner the bleeding point has been occluded and there is little likelihood that bleeding into the pericardial sac will recur.

5. Intravenous fluids and aspiration of the distended, compressing pericardium may quickly relieve the embarrassed heart and circulation in injuries where bleeding is not apt to recur.

6. Preparation for operation, in the event that the patient has not responded favorably to such a regimen, should proceed concomitantly.

7. When a wound of the heart is accompanied by intrapleural injury and hemorrhage or evidence of considerable external bleeding, even in the presence of tamponade, the indications for prompt blood replacement are present. It is difficult, without aspiration, to distinguish between symptoms caused by blood loss and those of tamponade, and they may be coexistent.

8. Again, when external bleeding has not been excessive, when there is little or no hemorrhage into the pleura in the absence of signs of cardiac tamponade, the possibility remains that much of the symptomatology may be due to reflex vasodilatation, as pointed out by Warren et al. It is not unreasonable that injury to a vital organ may be followed by such a sequence of events, but the degree of shock should not be deep and the patient should be easily aroused. Such was not wholly the case in any of our patients.

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NEW CONCEPT OF THE PATHOGENESIS OF URINARY LITHIASIS

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AN article entitled "Incidence of Urinary Calculi in the American Negro" by Dodson and Clark† suggested to the author that a new concept on the pathogenesis of urinary lithiasis illustrated by him in 1919 with experimental work and confirmed in 1927 with two particular, ideal clinical cases would be of some interest to the profession. This article by Dodson and Clark contains statistics and opinions of many others. However, they all agree that the incidence of urolithiasis among negroes is very low as compared with that occurring in whites. After considering some of the common hypothetic factors of the many theories, which have failed, based only on the components of the urine or alterations of metabolism, all these authors conclude they are unable to explain the pathogenesis of this semi-immunity. The writer believes that with his new concept the fact can be reasonably explained.

In 1919 a number of experiments were performed on dogs for the purpose of studying the behavior of normal urine or, if necessary, of urine artificially modified or infected, in contact with small pieces of foreign substances introduced into the kidneys. These foreign bodies were of such a size that they could not be passed through the ureters. Retained in the kidneys, these substances functioned as natural nuclei on which calculi could be formed.

In all seven nuclei introduced into the kidneys (Fig. 1), the first by pyelotomy and the others by nephrotomy and kept there for an average period of three months, deposits of salts were found and of all the salts contained in the urine, independently of their concentration (Table 1) and in the cases in which infection or semi-obstruction to the flow of the urine occurred, real calculus formations were obtained. (Fig. 2.)

This condition occurs in man when an occasional anatomic anomaly in any part of the urinary tract retains such nuclei as blood clots, groups of crystals, bits of gravel, collections of pus, etc. We are thus reminded of the great specific value that must be given this anatomic factor when considering the genesis of urinary lithiasis. The production of urinary calculi will not occur if this anomaly in the urinary tract does not exist, no matter what the composition of the urine or the alterations of metabolism.

TABLE 1

CHEMICAL AND MICROSCOPICAL FINDINGS IN THE SEVEN INCIDENCES OF CALCULOUS FORMATIONS

1. Sodium urate, lime phosphate, ammonium magnesium phosphate, few crystals of calcium oxalate, certain amount of organic substance, positive bacteriologic findings
2. Neutral ammonium magnesium phosphate in thin "bacilli-shaped" crystals, calcium sulfate, crystallized in form of prismatic needles forming "rosettes," negative bacteriologic findings
3. Ammonium magnesium phosphate, ammonium urate, some organic substance, positive bacteriologic findings
4. Good amount of amorphous urates, lime phosphate, neutral magnesium phosphate in thin bacilli-shaped crystals, negative bacteriologic findings
5. Lime phosphate, uric acid crystals of losangic shape, great amount of amorphous substance, few urate, germs of bacillary shape
6. Many crystals of lime phosphate, bicalcic phosphate wedge-shaped, united by the apices, ammonium urate, positive bacteriologic findings
7. Ammonium phosphate, ammonium urate, few irregular crystals of ammonium magnesium phosphate, great amount of amorphous substance, positive bacteriologic findings

Two particular clinical cases that were reported by the author at the meeting of

† *J. A. M. A.*, 132: 1063–1066, 1946.

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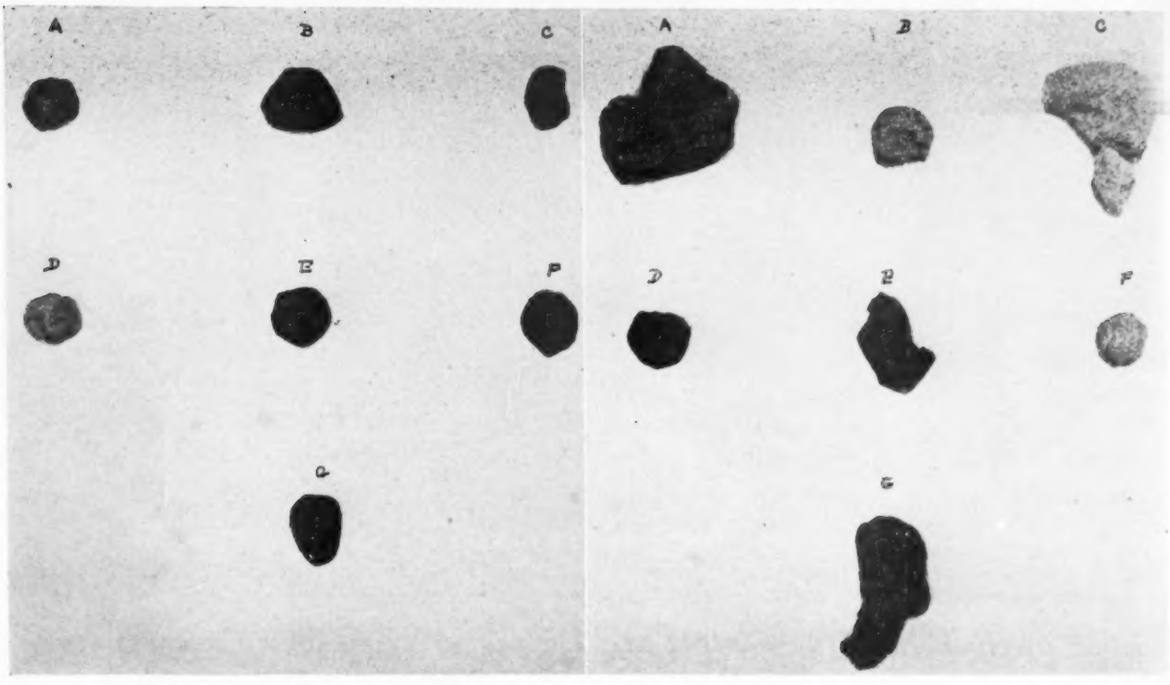


1 2

Fig. 1. Pieces of wood, stone and rubber introduced in the pelvis of the kidneys of dogs.
Fig. 2. Calculous formations on the same bodies after three months of being lodged in the pelvis of the kidneys.

the Italian Society of Surgery in October, 1927, in Parma, illustrate this assertion very clearly. These two cases presented factors that are always present even in micro-dimensions in all cases of urolithiasis.

A man came under the author's observation with severe urinary symptoms seventeen months after prostatectomy was performed by another surgeon. A large stone was found in the bladder the size and shape of a small egg. (Fig. 3.) This calculus had formed on a piece of necrotic tissue accidently left behind in the bladder at the first operation.

Another man presented himself to be operated upon for bilateral inguinal hernias. He could no longer bear the severe, insufferable urinary symptoms that started in mild form about ten years previously and which had become progressively worse. Since these are not the symptoms attributable to hernias, the possible presence of a pathologic condition of the prostate was considered. However, upon rectal examination a large, elongated, hard tumor was found prominent in the rectum behind a normal prostate and upon catheterization it was ascertained to be a stone.

At operation a large calculus the size and shape of a bar of common hand soap (Fig. 4A) was removed with great difficulty. One-half of this calculus protruded into the bladder and the other half, imbedded

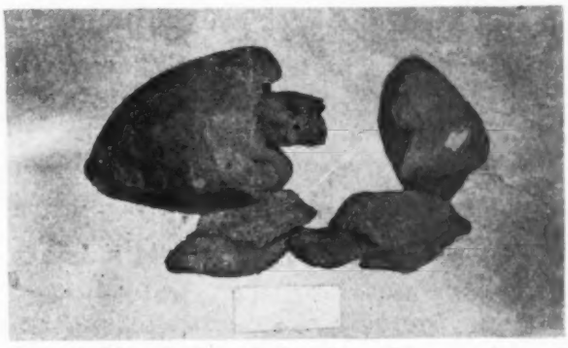
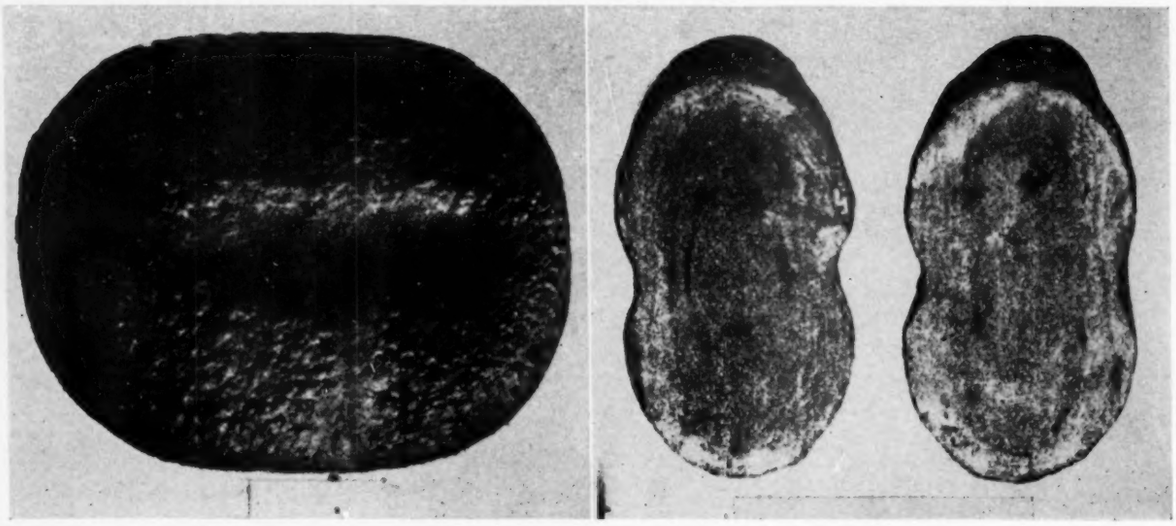


Fig. 3. Phosphatic calculus formed on a piece of prostatic tissue dislodged in the bladder.

in a diverticulum of the fundus of the bladder, dipped toward the rectum. The stone was tightly fixed by a strong ring of hypertrophied bladder tissue which left a constriciton (Fig. 4B) well outlined on the middle of the calculus. This man had suffered twenty years before with severe renal colic with bloody urine but without emission of any concretion. The nucleus very likely fell from the kidney, entered the



A B

FIG. 44 A, calculus with medial constriction produced by a ring of hypertrophied bladder tissue. B, same calculus transversally sectioned.

existing diverticulum of the bladder and remained there silent for over ten years.

In the first case if the piece of prostate had not been left in the bladder or if the substance was so small as to pass through the urethra, or in the second case if the diverticulum of the bladder did not exist and did not retain the nucleus, which had migrated twenty years before from the kidney, these two men very likely would never have suffered with calculi even though they possessed the ability to produce stones. No better proof exists, than that an anatomic anomaly in the urinary tract and an occasional nucleus are the real, true and only pathogenetic factors in urinary lithiasis.

All the other theories: of acid and alkaline fermentation (Scherer), of lithogen catarrh (Meckel), of supersaturation (Berzelius), of superposition (Chopart, Heller, Robin), microbic theory (Naunyn and Galippe), of colloids (Rainer, Harting, Ord, Shade), of cementing organic substance (Carter, Fourcroy, Moritz, Aschoff, Kleinschmidt) and the hystonecrotic theory (Ebstein, Pousson, Charles) are factors that involve the *formation* of calculi. They constitute the biochemical and biophysical, local and general underlying conditions favorable to the formation of calculi. The intrinsic essence of a calculus is simply influenced by the different characteristics of these conditions, namely, speed of formation, appearance, consistency and different structures, but a calculus will never be formed if the necessary anatomic condition capable of retaining that occasional nucleus does not exist in the urinary tract.

Based on this assumption many theories could be easily clarified. For example, why are calculi not formed in all septic cases and why not in all diathetic conditions with the urine supersaturated with different salts? The answer to this question is: Because the specific, absolutely necessary, pathogenetic factor, namely, the anatomic anomaly, is missing. At the same time other factors, considered until now only empirically in the etiology of urolithiasis, could be interpreted scientifically and objectively. The theories of inheritance, of different susceptibilities in different races and in different regions could all be explained. In the case of the negro whom we know possesses a well developed constitution, perfect dentition, freedom from dental caries, densely calcified bony structure, etc., it is not unreasonable to assume that his urinary organs also are more perfectly developed, and the rarity of existing anomalies explains the low percentage of urolithiasis.

TREATMENT OF INFECTIONS OF THE EXTREMITIES

CLINICAL RESULTS OBTAINED WITH A COMBINATION OF ICE, TOURNIQUET AND INTRA-ARTERIAL PENICILLIN

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A GROUP of workers at the Metropolitan Hospital, New York City, reported rapid improvement of infection in an extremity which had been treated with intra-arterial penicillin. The method of treatment they advocated required that a tourniquet be placed about the thigh of an infected lower extremity, shutting off the venous return from the leg but not tight enough to constrict the femoral artery. Penicillin was then injected into the femoral artery and the tourniquet allowed to remain *in situ* for fifteen minutes. This method was said to cause an extravasation of penicillin into the tissues of the leg and maintain a high concentration of penicillin in the tissues for the length of time the tourniquet was kept in place. These workers believed that the dictating factor responsible for the therapeutic success of this procedure was due to the increased concentration of penicillin extravasated into the tissues and to the prolonged time that the penicillin was maintained in the tissues.

The longer the tourniquet could be kept in place, the longer the penicillin could be trapped at the site of infection. If an extremity were to be packed in ice, no damage would result if the blood stream was cut off for several hours.

Gilbert and Call[2] have reported excellent results in treating wound infection by local infiltration of the wound with penicillin and maintenance of a high tissue level of the drug by keeping the site of the wound chilled with ice. In view of our success with the combination of ice and penicillin infiltration we decided to treat a series of wound infections of the extremities with ice, tourniquet and intra-arterial penicillin.

METHOD

Thirty cases of wound infection of the lower extremities were divided into two groups containing fifteen patients in each, designated group 1 and 2. Each group contained five patients with marked toxic symptoms such as hyperpyrexia, marked redness and tenderness about the wound and regional lymph node tenderness; five patients showed a moderate febrile response and a moderate amount of tenderness about the wound; and five patients showed only a mild systemic and local reaction toward the infection. The wounds in each group compared fairly well in regard to length, depth and irregularity of cut surface with the wounds of patients in each of the other groups. The infecting organisms were streptococci or staphylococci. None of the infections were produced by gram-negative bacilli.

PROCEDURE AND RESULTS

Group 1. The fifteen patients in this group received 50,000 units of penicillin intragluteally every three hours until symptoms of infection had remained absent for twenty-four hours. The total dosage was 500,000 to 2.5 million units. In the five severe cases of this group infection disappeared at the end of the sixth day in two patients, at the end of the fourth day in two and at the end of the third day in one.

In the five cases of moderately severe infections one patient was asymptomatic by the end of the fourth day, four by the end of the third day and one by the end of the second day.

In the five mild cases three patients were asymptomatic by the end of the first day

and twelve hours after initiation of treatment two were asymptomatic. The average hospitalization was eleven days.

Group 2. In the fifteen cases in this group eight ice bags were placed about the leg with an infected wound. The leg was chilled from the upper one-third of the thigh down to the toes. One hour later a tourniquet was placed about the chilled thigh, tight enough to cut off all venous return from the leg but loose enough to allow the femoral artery to remain patent. The patency of the femoral artery was assured if the pulsations of the dorsalis pedis could be felt.

The area over the femoral vein was prepared with tincture of merthiolate, and 500,000 units of penicillin dissolved in 20 cc. of sterile water were injected directly into the femoral artery. The tourniquet was left in place for three hours and the ice was not removed until twelve hours after the intra-arterial injection of penicillin.

In the five severe cases of this group infection disappeared at the end of the ninth day in three patients and at the end of the fourth day in two.

In the five cases of moderately severe infection one patient was asymptomatic by the end of the first day and four by the end of the fourth day.

In the five mild cases one patient was asymptomatic by the end of the second day, one by the end of the first day and three were asymptomatic twelve hours after initiation of treatment. The average hospitalization was eleven days.

COMMENT

Shutting off the blood to a chilled extremity for several hours seems to be without danger. We have left a tourniquet on the thigh and have shut off the venous return of a chilled leg for as long as seventeen hours without damage to the extremity. The tourniquet which constricts the venous return but allows the femoral artery to remain patent creates a high venous pressure in the leg. An edema results and, of course, carries penicillin (which has previously been injected into the femoral artery) out into the tissues. However, this edema probably lowers the tissue resistance to infection for it has long been recognized that an infection in edematous tissue is most difficult to control. The administration of penicillin in the usual interrupted intragluteal method is far less troublesome and is as effective or probably more effective in combating wound infections of the extremities than the more cumbersome use of ice, tourniquet and intra-arterial penicillin.

Gilbert, Call and Roose[3] demonstrated that penicillin could be kept concentrated at the site of an infected wound for at least twenty-four hours after the area surrounding a chilled wound was locally infiltrated with penicillin. This appears to be a more effective and less cumbersome method of keeping penicillin localized than by the use of a tourniquet.

SUMMARY AND CONCLUSIONS

The results in the treatment of fifteen patients with wound infection by means of ice, tourniquet and intra-arterial penicillin were compared with the results obtained by treating fifteen patients with similar wound infection by means of the usual interrupted intragluteal penicillin therapy.

There is no therapeutic advantage in the use of a combination of ice, tourniquet and intra-arterial penicillin over the results obtained by the use of interrupted intragluteal penicillin as outlined in this series of cases presented.

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Case Reports

BENIGN ULCER OF THE GREATER CURVATURE OF THE STOMACH*

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THE location of an ulcerative lesion in the stomach is one of the most reliable guides in deciding upon the probability of its being benign or malignant. The hazards of conservative treatment in this regard have been fairly well determined. This is especially true in lesions of the greater curvature which are nearly always malignant. The other common criteria such as the age of the patient, duration of symptoms, size of the lesion, gastric acidity and response to ulcer therapy are notoriously undependable in making the decision in the individual case as to the necessity for operation. In the experience of the Massachusetts General Hospital[1] lesions of the greater curvature are malignant in 100 per cent, of the prepyloric area in 65 per cent, of the anterior and posterior walls in 20 per cent, of the pylorus in 10 per cent and of the lesser curvature in 10 per cent. Similar figures are reported from the Mayo Clinic.[5] Wiley[21] in his review on gastric ulcer has found prepyloric ulcer variously reported as 75 to 83 per cent malignant.

The rarity of benign ulcers of the greater curvature is attested to in general terms by Kirklin,[9] Palmer,[12] Templeton[20] and Bockus.[4] In 1931 Pancoast, discussing a paper by Sproul,[17] said he had encountered but one case; L. G. Cole, discussing the same paper, admitted being wrong both times he had made such a diagnosis. Lahey[10] has never seen a benign ulceration of the greater curvature.

Sproul's communications with leading roentgenologists in 1931[17] showed not one who had a histologically confirmed diagnosis of benign greater curvature ulcer. He is critical of the many case reports, such as Blaine's three cases[2] which had no histologic confirmation, and could find only ten histologically proved cases in the literature up to 1928. Holmes and Hampton[8] cite Orator's study of 330 cases of gastric ulcer from Eiselberg's clinic without a single benign ulcer of the greater curvature.

Rivers and Dry[16] found records of only four cases in the files of the Mayo Clinic up to 1935; their patient was a girl of twenty-one whose film showed a large ulcerating greater curvature lesion deemed malignant preoperatively. At operation a benign 2 cm. crater was found 5 cm. above the pylorus, with no histologic evidence of malignancy.

Matthews[11] reiterated the need for microscopic study before a diagnosis of benign greater curvature ulcer is made. His first case was a woman of fifty-seven with symptoms of thirty-five years' duration and no free hydrochloric acid. His second case was a man of fifty-seven with symptoms of one year's duration, somewhat high free hydrochloric acid of 52 units and a palpable mass. In both cases an apparently malignant greater curvature filling defect by roentgenogram proved benign at operation, the mass in the second being inflammatory due to chronic perforation.

* From the Roentgenologic Service, United States Veterans Administration Hospital, Aspinwall, Pa. Published with permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the author.

Williams[22] reported two cases of benign greater curvature ulcer found at autopsy, the only examples in the hospital records at San Francisco Hospital up to 1941. Both patients were admitted in a moribund state and died shortly after. The lesion in the first case was prepyloric with a large six-hour retention and no free hydrochloric acid; in the second case it was a large ulcer 6 cm. from the pylorus.

Clagett[6] reviewed all cases of chronic gastric ulcer treated surgically at the Mayo Clinic from 1933 to 1937, 272 in all, 220 men and 52 women: 182 (67 per cent) were on the lesser curvature at or above the angle, 43 (16 per cent) were on the lesser curvature between the angle and pylorus, 41 (15 per cent) were on the posterior wall near the angle, 2 were on the anterior wall and 4 (1.4 per cent) were on the greater curvature.

Allen and Welch[1] studied the records of all patients with a diagnosis of gastric ulcer treated at the Massachusetts General Hospital for the ten-year period 1930 to 1940. Of the total of 255 benign ulcers analyzed none were on the greater curvature. Of the patients whose clinical diagnosis was gastric ulcer 14 per cent proved to have carcinoma. All lesions of the greater curvature were malignant.

A study of over 200 cases of large gastric ulcers seen at the Cook County Hospital in the ten years prior to 1943[18] revealed over 90 per cent in the pars media of the stomach but none on the greater curvature. At the Lahey Clinic[10] 8,516 cases of peptic ulcer have been treated with bed management; of these 571 were gastric, a ratio of duodenal to gastric ulcer of about 14 to 1. None were located on the greater curvature and Lahey concludes that "while these have been reported, anything other than radical surgery for the patient with an ulcer on the greater curvature is futile."

The case reported by Preiss[15] from England in 1944 was a thirty-four year old man with symptoms of eighteen years' duration. Roentgenograms demonstrated an ulcerative lesion of the greater curvature with folds converging toward the niche. Operation, performed because of failure to heal and the danger of malignancy, disclosed a chronic gastric ulcer. Blum's case[3] reported in 1944 was the first at the United States Veterans Hospital, New York City, among several thousand peptic ulcers of which several hundred came to operation. His patient, a forty-nine year old man who had symptoms for twelve years, was referred to the hospital with a diagnosis of gastric carcinoma after severe hemorrhage. His free hydrochloric acid was 57 and roentgenograms showed a niche 2.5 cm. in diameter on the greater curvature with prominent ruga converging toward it; at operation the chronically perforating gastric ulcer adherent to the serosa of the transverse colon was found 6 cm. from the pylorus on the greater curvature. Even with the lesion in his hand, the surgeon was uncertain whether it was benign or malignant.

Necropsy studies have not contributed much because of their apparent discrepancy with clinical studies, especially in the ratio of duodenal to gastric ulcer, but also in the abnormal incidence of clinical rareties. Among 7,700 consecutive necropsy records at Bellevue Hospital[10] 1904 to 1922, there were 120 cases of gastric ulcer of which nineteen were on the greater curvature and only forty-one on the lesser curvature. The applicability of such figures, when compared with reliable clinical studies, may be seriously questioned because of the known occurrence of gastrointestinal ulceration in agonal states.

Portis and Jaffe[14] found 196 gastric and 146 duodenal ulcers in 9,171 consecutive autopsies at Cook County Hospital. Gastric ulcer was the essential lesion in fifty-five, duodenal ulcer in sixty-three. This is in marked contrast with clinical figures of about fourteen duodenal to one gastric ulcer at the Lahey Clinic and about ten to one at the Mayo Clinic. Of the 196 gastric ulcers 116 (59 per cent) were within 6 cm. of the pylorus: ninety-seven on the lesser curvature, ten on the anterior wall, six on

the posterior wall and three on the greater curvature; forty-nine or 25 per cent were more than 6 cm. from the pylorus, one being on the greater curvature. It is obvious that necropsy and clinical studies are not directly comparable when, in addition to the discrepancies first noted, the clinical incidence of almost 90 per cent of gastric ulcers in the pars media of the stomach is recalled.

The case to be reported is the first case of a benign greater curvature ulceration to be found in the records of the United States Veterans Hospital at Aspinwall, Pa.

CASE REPORT

G. R., a forty-six year old white hospital attendant, was admitted to this hospital February 15, 1946, complaining of abdominal pain, nausea, vomiting, weight loss, weakness and malaise. For about three weeks before admission he had mild dull pain over the left lower ribs and in the epigastrium, with the onset of severe epigastric pain unrelated to food, nausea and frequent vomiting two days prior to admission. He claimed to have lost 25 pounds the month before admission. Digestive complaints had been rare prior to the present episode. Upon examination he appeared to be weak and pale; he was edentulous. Blood pressure was 148/80, heart and lungs were essentially negative. The abdomen was soft and flat; there was some epigastric tenderness but no masses were palpable. Upon admission it was found that the Wassermann and Kahn tests were negative; urine negative; hemoglobin, 87 per cent (15 Gm.); red blood cells, 4.6 millions and white blood cells, 9,950.

Because of the repeated vomiting for the first three days, the patient had a liquid tray with supplementary intravenous infusions of glucose and normal saline. A No. 1 Sippy diet was begun on the third day. Vomiting ceased two days after admission, the pain and tenderness generally disappeared and he began to eat, feel well in general and put on a little weight.

Roentgen examination of the stomach March 1, 1946, (Fig. 1) showed a crater-like protrusion on the greater curvature at the junction of the middle and distal thirds. At six hours the stomach was empty except for a small amount of barium retained in this crater. Gastroscopy on March 11th visualized no lesion nor was one demonstrated upon repetition of the roentgen studies on March 25th. On March 9th his blood count and sedimentation rates were normal. Fasting gastric residue was 11 cc., free hydrochloric acid 17 with a total of 32. He continued to feel well and was eager to return to work. He was discharged April 6th with a recommendation to return in six weeks for reexamination.

Fig. 1. Roentgenogram of March 1, 1946, showing the crater on the greater curvature of the stomach at the junction of the middle and distal thirds.

Roentgen studies on May 31, 1946, reported a suspicious lesion on the greater curvature just proximal to the prepyloric area. He was readmitted June 11th complaining of some distress deep in the abdomen present since his last roentgen examination. It occurred one hour after meals, on an empty stomach or at night and was relieved by milk. There was no vomiting or evidence of bleeding. Physical examination was essentially negative, the abdomen being flat, soft and non-tender; blood and urine studies were normal. Gastroduodenal roentgen study on June 13, 1946, (two days after readmission) showed a prominent rugal pattern, ragged and irregular in appearance,

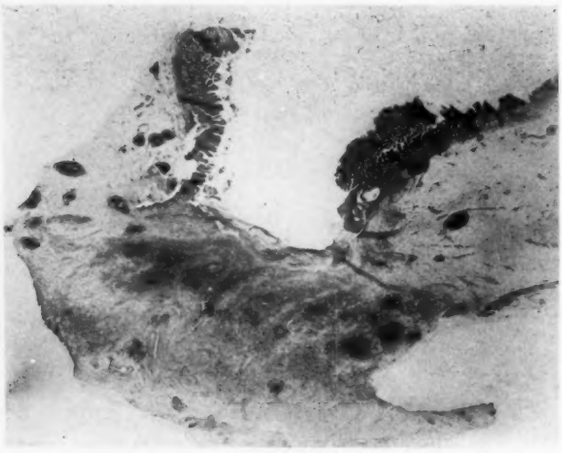

FIG. 2. A low power view through a typical area showing normal mucosa at the margins of the ulcer, dense fibrosis extending to the serosa and heavy diffuse and perivascular infiltration of lymphocytes. No evidence of malignancy.

particularly in the lower portion and along the greater curvature where there was a persistent projection with rugal folds running into it. This area of the greater curvature was the same in position and appearance as the original crater visualized; it was somewhat tender. There was slight gastric retention at four hours. The roentgenologic diagnosis was ulcer of the greater curvature of the stomach, probably malignant.

This diagnosis was concurred by the surgical consultant and radical partial gastrectomy was performed July 2, 1946, with removal of the omentum and several small soft glands from the anterior surface of the head of the pancreas. The indurated area on the greater curvature was about 7 cm. proximal to the pyloric ring. No evidence of metastatic malignancy was seen in the abdomen.

The patient made a fairly uneventful recovery. Reexamination on July 23rd showed a well functioning anastomosis, with no evidence of recurrent ulceration. His hospital stay was somewhat prolonged by his emotional instability which had prevented preoperative gastroscopy and gastric analysis, but he was finally discharged September 4, 1946, in good condition.

Pathologic examination of the resected specimen (Fig. 2) revealed two ulcers astride the greater curvature 5.5 cm. from the pyloric end, 3.2 and 0.5 cm. in greater diameter, respectively. The margins were sharp, the base firm and fibrous. In the ulcerated areas the mucosa and submucosa were replaced by chronic granulation tissue; there were some areas of fibrosis and some areas densely infiltrated with chronic inflammatory cells (mainly lymphoid). The stomach wall throughout was thickened, with fibrosis of the muscular and serosal layers and infiltration of the mucosal and submucosal layers with round cells, macrophages and eosinophiles. In one area the gastric mucosa was covered by a thin acute inflammatory exudate consisting largely of polymorphonuclears. All layers of the stomach were heavily infiltrated with inflammatory cells. Perigastric and omental lymph nodes showed moderate follicular hyperplasia.

Pathologic diagnosis: (1) chronic gastric ulcer; (2) acute and chronic gastritis.

COMMENT

In this case the age of the patient, lack of chronicity of symptoms, low acidity, recurrence and particularly the location of the lesion all suggested malignancy; the severity of the pain, the strong psychogenic factors present and the striking response to medical treatment all favored a diagnosis of benign peptic ulcer. However, the extreme infrequency with which ulcerative lesions of the greater curvature prove to be benign makes operation mandatory, regardless of the patient's suitability as an operative risk.

Why the greater curvature of the stomach is so immune to peptic ulceration has not been adequately explained. Even malignant lesions involve the greater curvature less frequently than other parts of the stomach. The factors of less mechanical irritation and trauma and of better blood supply to the greater curvature than to the lesser may play a part[11] but this remains conjecture.

SUMMARY

1. The more recent literature on the incidence of benign ulcer of the greater curvature is reviewed showing its marked infrequency even in large clinical experience.

2. A case of benign ulcer of the greater curvature of the stomach is reported which

was proved by operation and careful pathologic study.

3. Benign ulceration of the greater curvature of the stomach is a diagnosis to be made only after histologic examination of the resected lesion.

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METASTASIZING CARCINOID TUMOR OF THE APPENDIX AND CECUM*

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CARCINOID tumor of the appendix has been frequently reported in the literature. Tumors of this type occurring elsewhere in the gastrointestinal tract are infrequent. Lubarsch in 1888 was the first to describe a carcinoid tumor of the ileum. He reported two cases of multiple nodules in the ileum and noted the striking histologic and clinical differences between these tumors and the adenocarcinomas found elsewhere. However, despite their being atypical, he designated his cases as "primary carcinomata" of the ileum. In 1890 Ransom reported other structural details of tumors which are now generally recognized to have been carcinoid tumors. The origin of the tumor has been the subject of much discussion. They have been thought of as endotheliomas by some, by others as related to basal cell carcinomas. In 1907 Oberndorfer introduced the name carcinoid to emphasize their malignant appearance in contrast to what he considered the harmless clinical course.

In 1914 Gosset and Masson[1] noted that the argentaffin or Kultschitzky cells, which are found diffusely distributed throughout the mucosa of the gastrointestinal tract, the pancreas and the gallbladder, reduced an ammoniacal solution of silver salts. Silver-staining granules in the cytoplasm were demonstrated. When the carcinoid cells were treated by the same silver impregnation methods, the same granules were observed. It is now generally accepted that the carcinoid tumor arises from these Kultschitzky cells. The term argentaffinoma has been applied because of the silver-staining properties. This theory would well explain the fact that carcinoids have been found in various parts of the gastrointestinal tract and in the gallbladder. However, it would be difficult to understand the appearance of primary carcinoids in the mesentery. One theory that has been formulated which would clarify this problem has been that the argentaffin cells are derived from the neuroectoderm, migrate first to the celiac ganglions and then along the courses of nerves to the intestinal wall and finally reach the mucosa. The opinion is advanced that some of these cells may remain behind in the mesentery and later produce carcinoid tumors.

OCCURRENCE AND PATHOLOGY

The appendix is known to be the most common site for the tumor with the small intestine being second in frequency. The large bowel, the remainder of the gastrointestinal tract and the gallbladder follow in somewhat that order. No special predilection for either sex is noted. Generally speaking, carcinoids are found in approximately 0.3 per cent of all routine surgically removed appendices and constitute 90 per cent of all tumors of the appendix. Eighty-five per cent of all carcinoids occur in the ileocecal region including the ileum and the appendix. To date, according to Reitz[2] 400 malignant intestinal carcinoids have been reported. Although Forbus[3] originally considered them to be benign, Wyatt[4] stated that 22.5 per cent of recorded carcinoids of the small intestine were malignant. The per cent of malignancy in carcinoids in unusual locations (outside the appendix and small intestine) is thought to be 25. As for malignancy in the appendiceal carcinoids this is extremely rare.

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Raiford[5] in 1933 reported the incidence of carcinoids in the pathology laboratory of the Johns Hopkins Hospital. He found twenty-nine cases among 62,000 specimens which included autopsy and surgical material. There was one carcinoid of the stomach, nine of the small intestine, one involving the appendix and two in the large bowel. In two cases the tumor had multiple origin. Porter and Whelan[6] in 1939 reported an incidence of appendiceal carcinoid of 0.2 to 0.5 per cent of all surgically removed appendices. Of 26,384 appendices removed at the Boston City Hospital from 1910 to 1937 seventy-two contained argentaffinomas. During the same period two carcinoids of the stomach, one of the gallbladder and eight of the small bowel were found. None was found in the large bowel. Only three of the extra-appendiceal primary tumors metastasized. None of the appendiceal tumors was malignant. One of the extra-appendiceal metastasizing tumors was multiple with a probable primary seat also in the appendix. The authors assumed that the metastases occurred from the extra-appendiceal primary carcinoid in the ileum and not from the appendix. Ashworth[1] described the unusual locations of twenty-eight carcinoid tumors he collected. He found the colon to be the most frequent site of occurrence outside the appendix and the small intestine. There were eleven cases of carcinoids of the large bowel in this series. Only two of these involved the cecum. There were seven cases involving a diverticulum, six cases in the stomach, two cases in the gallbladder and two in the mesentery. In seven of the twenty-eight cases metastasis had occurred.

Carcinoid involvement of the cecum is rare. Potter and Docter[8] in 1944 reported a malignant carcinoid of the cecum with metastasis. Note was also made of four malignant cecal carcinoids reported previously.

Reitz[2] states that of 2,520 consecutive appendices removed surgically within a five-year period at the Sacred Heart Hospital in Pennsylvania from 1940 to 1945, there was an incidence of 0.08 per cent carcinoids, 0.04 per cent carcinoids with malignancy and 0.08 per cent primary carcinoma. He also notes twenty-one previously reported cases of malignant carcinoids of the appendix and reports at the same time his own case of malignant degeneration of an appendiceal argentaffin tumor. In this case the appendix was removed before the lesion had metastasized to regional lymph nodes; it, however, had spread into the serosa and infiltrated the appendiceal border of the meso-appendix. It seems important at this point to mention the opinion of many investigators of this subject that so far as the metastasizing potentialities of appendiceal carcinoids is concerned these do not differ from carcinoids in other locations. They produce, however, symptoms of appendicitis and are frequently removed early before metastasis can occur; other carcinoids metastasize while locally "silent."

As for the pathologic aspects of the tumor involvement of the appendix produces a characteristic gross appearance so that the diagnosis may be made from gross inspection alone. The appendix is usually thickened and fibrotic. The lesion is usually near the tip and here one may see a nodular or bulbous swelling. The tumor is usually small, not exceeding 2 cm. in diameter. Cross section reveals a typical yellowish surface. While the tumor in the appendix is usually solitary, those occurring in the small intestine are frequently multiple. Stevenson[9] reports one case in which sixty-eight discrete tumors were found in the ileum at operation. Neoplastic involvement of the small bowel frequently causes obstruction. This is apparently due in most cases to a kinking or angulation from mesenteric metastasis rather than to the actual tumor itself. The lesion seems to extend outward into the muscular coats rather than project into the lumen.

Microscopically, anastomosing cords of cells are seen. The cells are quite small, polygonal in shape and extremely uniform

in size. The nuclei are dark-staining, vesicular and rounded or ovoid. The cytoplasm usually has an indistinct border and is finely granular. Small droplets which take a lipoid stain can usually be demonstrated. Occasionally minute glandular spaces are formed lined by columnar cells but this is uncommon. The uniformity of the cells and the absence of mitotic activity and nuclear uniformity differentiate this tumor from carcinoma. A comparison of the histologic features in cases exhibiting metastases and those remaining as local tumors reveals no essential difference so that one can state only that all carcinoids have the potential power of metastasizing. According to Masson, the final histologic diagnosis of a carcinoid depends on the identification of the argentaffin granules in the protoplasm. However, many believe that this is not necessary. Forbus[3] and others believe that it is possible to make the differentiation from adenocarcinoma, for instance, on a purely morphologic basis.

Malignant carcinoid spreads by lymphatics and by venous invasion of tumor cells. While it should be pointed out that the tumor may thus metastasize and cause the patient's death, in some cases even though metastasis is present, the prognosis may still be good. This is due to the tumor's slow growth. Although local metastasis is common, generalized metastasis is rare. It should be stated that the presence of metastatic lesions should not prevent the surgeon from removing the primary site of the tumor. Mallory[10] refers to a case followed for twenty years after resection of a segment of ileum. "At the operation, metastatic nodes were noted deep in the mesentery. At the time of death from lobar pneumonia, they were still present but had not extended any further throughout that period." Stevenson's[9] case involved resection of the ileum for what was diagnosed adenocarcinoma of the carcinoid type with metastasis to the liver. Two years later the patient was noted to be doing well.

CLINICAL ASPECTS

Symptoms vary according to the region involved. In appendiceal carcinoid it is not unusual to find that the symptoms are those of typical appendicitis or, in the case of small bowel involvement, one may be presented with a picture of chronic intestinal obstruction. Anorexia and weight loss are common complaints. Upon examination one may occasionally palpate an abdominal mass. Blood in the stool is not common because of lack of ulceration of the tumor.

We wish to add the following case of malignant carcinoid of the appendix and the cecum to those few already reported. The case is interesting because of its rarity and because of the problem of determining the primary site.

CASE REPORT

The patient was a sixty-two year old white male who was admitted to Goldwater Memorial Hospital on May 21, 1946, with the chief complaints of dyspnea and swelling of both legs for four years, anorexia for one year and loss of weight for two years. He was well until he became ill in 1942 with bilateral ankle swelling and mild dyspnea. He was told he had heart disease. His symptoms abated somewhat when he went back to doing work that was less strenuous. In 1945 he noticed diminution of appetite, nausea, vomiting, weakness and a resumption of ankle swelling. He also observed occasional tarry stools. In September, 1945 the patient was admitted to St. Luke's Hospital in New York where a barium enema was given. Retrograde obstruction in the region of the hepatic flexure was demonstrated. A tentative diagnosis of carcinoma of the hepatic flexure was made. However, the patient subsequently left the hospital against advice. On December 7th he returned. Physical examination at that time revealed the abdomen to be soft; the liver was palpable four fingers below the costal margin. An irregular firm mass about the size of an orange was palpable in the right mid-abdomen distal to the liver. A repeat barium enema was given which confirmed the findings referred to previously. An exploratory laparotomy was subsequently performed. At operation the peritoneum of the entire right posterior aspect of the abdomen from the level of the inferior pole

of the right kidney to the pelvic brim was pushed forward by a large retroperitoneal tumor. This was biopsied and a large argentaffin tumor or possible metastatic carcinoma was reported. Although no direct involvement of the bowel was seen, the tumor had involved the mesentery of the ileum and the peritoneal attachments of the right colon to such an extent that it was thought that partial obstruction was undoubtedly present. For this reason an ileotransverse colostomy was performed. The patient made a relatively uneventful recovery except for a bout of pneumonia which was treated successfully. He was subsequently discharged to a convalescent home on January 3, 1946. However, he continued to feel badly with anorexia, vomiting and continuing weight loss. There was no diarrhea. He was subsequently referred to Goldwater Memorial Hospital because of cardiac decompensation.

At physical examination the patient appeared cyanotic and chronically ill, with wasting apparent about the upper part of the trunk. Blood pressure was 110/60 mm., temperature 98.6°F., pulse rate 100 per minute and respiratory rate 24 per minute. His chest revealed an increased anteroposterior diameter. The heart was enlarged somewhat to the left. A loud, rough, systolic murmur was heard at the apex and base and was transmitted to the great vessels of the neck. Bilateral pulmonary basal râles were heard. The abdomen exhibited a right, pararectal, incisional scar approximately 4 inches in length with a small defect in the lower portion. A mass was palpated in the right upper quadrant; it was difficult to determine whether or not it was an enlarged liver. There were no other masses palpated. The extremities exhibited a 4 plus pitting edema. Impression on admission was arteriosclerotic heart disease, chronic bronchitis and emphysema and abdominal malignancy with metastasis.

Laboratory findings revealed 4,000,000 red blood cells and 11,800 white cells per cm. The hemoglobin was 11 Gm. per 100 cc. Serum proteins were 6.5 Gm. per cent with an albumin globulin ratio of 2.6/3.9; the cholesterol was 162 mg. per cent and esters, 89 mg. per cent. The bromsulphalein test revealed no dye in the blood after thirty minutes. The van den Bergh, test direct and indirect, were normal. The blood Kahn was negative. X-rays of the chest revealed moderate emphysema and pleural thickening. The heart was slightly enlarged. A gastrointestinal series was interpreted as revealing "an abnormal pattern of the small intestines." The cecum and ascending colon showed "irregularities which may be postoperative in origin."

The patient was treated for cardiac decompensation and improved considerably. However, on June 27, 1946, he signed himself out of the hospital. No more was heard of him until September 17th when he expired at home. The immediate events leading up to his death are not known.

Examination at autopsy revealed a bilateral pleural effusion. The lungs exhibited moderate congestion, edema, some atelectasis and chronic bronchitis. The heart was slightly hypertrophied and exhibited a localized fibrinous pericarditis. A chronic mitral and tricuspid valvulitis of rheumatic origin was present. When the abdomen was opened, 1,500 cc. of yellow fluid containing fibrin was found in the peritoneal cavity. The omentum was adherent to the operational scar; the peritoneum of the posterior abdominal wall was thickened. A side-to-side anastomosis of the terminal portion of the ileum to the transverse colon, forming an ileotransverse colostomy, was present. The mesentery was studded with small, yellowish nodules measuring approximately 1 cm. in diameter. The liver which weighed 1,660 Gm. and was brown in color extended two fingers below the costal margin. The surface presented whitish nodules which varied in size from 0.5 to 1 cm. in diameter. On cut section these nodules were seen to extend into the parenchyma for approximately 0.5 cm. The bare area of the liver was replaced by a white fleshy-appearing mass, approximately 8 cm. in diameter which penetrated deeply into the parenchyma. This mass was quite firm and in its central portion was seen a small, yellowish, friable area about 0.2 cm. in diameter. The remainder of the liver appeared to be grossly normal. The gallbladder showed no gross changes. The gastrohepatic ligament was markedly thickened and infiltrated. The upper gastrointestinal tract was not striking except for the ileotransverse colostomy referred to previously. In the region of the ileocecal junction posteriorly a large lymph node, 4 cm. in diameter, was noted which was quite firm and white in color. The appendix was retrocecal in position and was attached to the posterior wall of the cecum by thin fibrous adhesions. It meas-

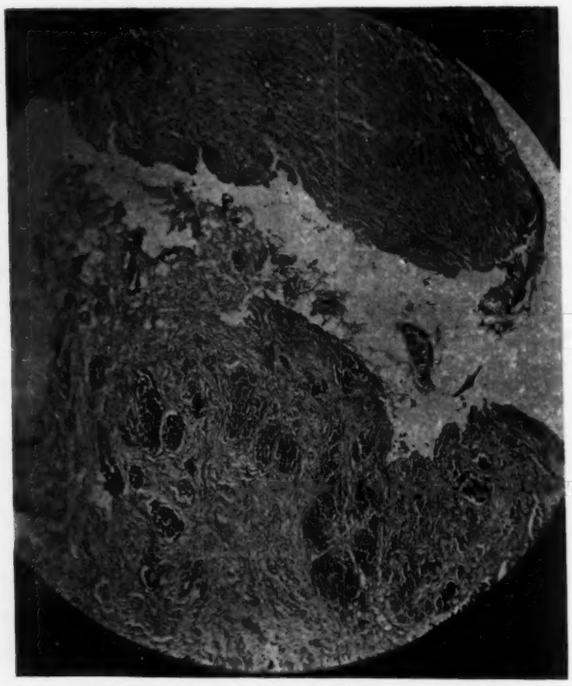

FIG. 1. Islands of small dark-staining cells infiltrating the wall of the appendix. The cells are uniform in appearance. There is no tendency to form glandular structures. There is abundant connective tissue.

ured approximately 5 cm. in length and was kinked on itself in its central portion. It was moderately thickened and grayish-white in color. The cut section revealed a yellowish-white surface with a markedly thickened wall surrounding the lumen. Within the cecum on the posterior wall close to the region of the ileocecal valve, a tumor was observed which measured 5 by 4.5 by 2.5 cm. and was brown-red in color and cauliflower in shape. The mass was sessile and no ulceration was observed. There was only slight encroachment upon the lumen of the cecum; the remainder of the large intestine was normal in appearance. There was no evidence of a large retroperitoneal tumor as referred to in the report of the operation. There was a widespread involvement of the lymph nodes. The peribronchial, para-aortic and mesenteric glands were infiltrated and had a fleshy appearance. The remainder of the autopsy was not significant.

Microscopic sections of the appendix revealed replacement of much of the mucosa and submucosa with fibrous tissue. (Fig. 1.) There was infiltration with smaller and larger masses of cells of varying size separated from each other by fibrous trabeculae. The cells were of relatively uniform appearance small and dark with only slight variation in size, shape and

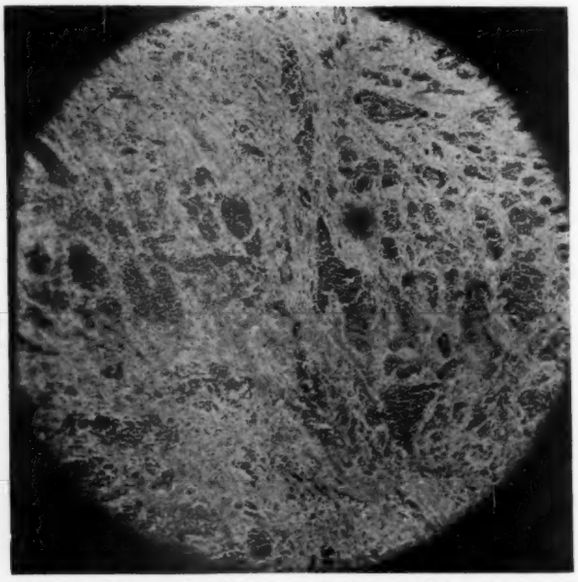

FIG. 2. The wall of the cecum invaded by sheets of cells which are of similar appearance as those in Figure 1.

FIG. 3. Metastatic lesion in the liver; this section shows the presence of acinar structures and pseudo-rosettes.

staining characteristics. The nuclei were dark and pyknotic. The cytoplasm was eosinophilic and of moderate amount. The muscularis of the appendix was hypertrophied and the adventitia was thickened. These layers were also infiltrated with neoplastic cells but to a lesser extent. Section of the cecum exhibited replacement of the mucosa by fibrous tissue with many spaces seen in which sheets of small cells resembling those just described were found. (Fig. 2.) Collections

of these cells were observed in the muscular and adventitial coats. The adventitia was composed of dense fibrous tissue. The liver revealed in one area disruption of the architecture by large, patchy overgrowths of fibrous tissue. Moderate round cell infiltration and proliferation of bile ducts were evident. Several areas of hemorrhage were noted. In the region of the tumor the parenchyma was disrupted by malignant neoplasm. (Fig. 3.) This consisted of masses of neoplastic cells which had a tendency to form small acinar structures. Small groups of cells were seen infiltrating the fibrous stroma. Many dilated and congested capillaries were present. A section of the ileocecal lymph node showed complete destruction of the architecture with replacement by fibrous tissue. Within the latter masses of tumor cells were noted. Occasional giant cells with pyknotic nuclei were also observed. The capsule was invaded. Argentaffin stains revealed blackish-staining granules in the cytoplasm of some of the tumor cells. A diagnosis of malignant carcinoid of the appendix and of the cecum with metastases to the lymph nodes and to the liver was made. An incidental diagnosis of cirrhosis was also made.

COMMENT

The direct cause of death in this patient was probably unrelated to the tumor, presumably being cardiac in origin. It is extremely difficult, if not impossible in this case, to determine the primary site. The tumor may have been primary in the appendix and then metastasized to the cecum, liver and nodes. The possibility of the neoplasm being primary in the cecum with metastasis to the appendix appears less likely. Another reasonable explanation is that the primary site was multiple, arising simultaneously in the appendix and cecum. Certainly malignant carcinoid of the appendix is rare, Reitz[2] having reported the twenty-second case. Even more uncommon is malignant carcinoid of the cecum, Potter[8] having reported the fifth case in 1944.

SUMMARY

A review of the literature on carcinoid with a case of malignant carcinoid of the appendix and of the cecum have been presented. Metastases to the lymph nodes and the liver were present. Although few cases of malignant carcinoids are reported in the literature, the tumor can no longer be regarded as invariably benign. The neoplasm is slow-growing and the presence of metastases should not prevent the surgeon from removing the primary site.

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PAPILLARY CYSTADENOMA LYMPHOMATOSUM*

BILATERAL INVOLVEMENT

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PAPILLARY cystadenoma lymphomatosum, or adenolymphoma of the salivary glands, has been the subject of several papers in recent years. It can still be considered a rather uncommon tumor. Albrecht and Artz[1] in 1910 first recognized this tumor as an entity. A review of the literature indicates ninety-one reported cases to date. Six cases of bilateral involvement were cited. The first bilateral case was reported by Nino[2] in 1941. Plaut[3] reported one case in 1942, Ramage et al.[4] one case in 1943 and Martin and Ehrlich[5] reported three in 1944. The latter authors reported 5 per cent of their series of twenty-two cases as occurring homolaterally multiple. We wish to report an additional case of bilateral involvement (in which multiple tumors presented on one side).

CASE REPORT

The patient was a white male, aged sixty-one. He was seen on January 19, 1944, with the complaint of painless swellings of the face and neck. The mass in the left face had been present for two and one-half years, the one in the right neck for about six months.

The tumor mass in the left parotid (Fig. 1) occupied the central part of the gland. Its size was 6 by 4.3 cm. There was a second tumor immediately under the lobe of the ear on the same side which was 2.5 cm. in diameter and was definitely attached to the parotid gland. Both of these tumors were firm, were pseudofluctuant and were unattached to the skin or fascia. Two additional tumors were found on this side at the time of surgery.

The tumor mass on the right side (Fig. 2) presented in the neck anterior to the sternocleidomastoid muscle and extended from the angle of the jaw to the level of the upper border of the thyroid cartilage. The tumor measured 3.8 by 2.5 cm. It was fluctuant and freely movable.

Operation was performed on February 8, 1944, under local anesthesia. A preauricular incision was made on the left side. The capsules of the tumors were isolated below the capsule of the parotid gland. The large mass in the central portion of the gland was removed from beneath the trunk and branches of the facial nerve which were spread over its external surface after exposing the facial nerve and carrying the dissection into the gland proper for a short distance. The second tumor was removed after extending the skin incision onto the neck. Two additional tumors, measuring about 1.2 cm. in diameter each, were removed on this side. They were located deep in the gland between the ear and the large centrally located parotid tumor. The incision on the right side paralleled the jaw. The superior end of this tumor was attached to the parotid gland. The mass was removed intact.

The tumors were examined by the pathologist at Blodgett Memorial Hospital. The following are his findings: "Specimen consists of four masses of tissue from the left face and one from the right side of the neck. Each is well encapsulated though there are fibrous strands attached to the surface. One of the masses from the left and the one from the right are cystic and fluctuant. The former measures approximately 5 cm. across and contains thick, mucinous material. The latter measures approximately the same and contains thick, brown, putty-like material. The wall of the latter is thin and its lining is covered by numerous small papillary projections. One firm area is found in the wall and a smaller separate cyst is also present in the wall. The masses taken from the left are composed of soft, grey, friable, nodular tissue and even the more solid masses contain small cysts with contents similar to that described in the one which was completely cystic. The largest solid

* From the service of Dr. Ferris Smith, Blodgett Memorial Hospital, Grand Rapids, Mich.

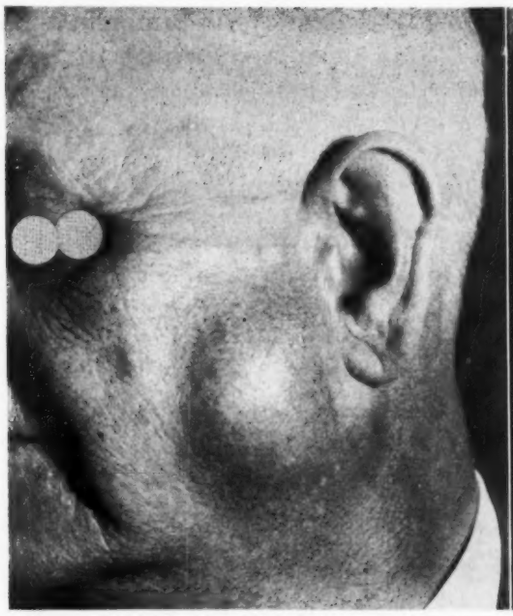

Fig. 1. Preoperative illustration of left-sided tumor.

Fig. 2. Preoperative illustration of right-sided tumor.

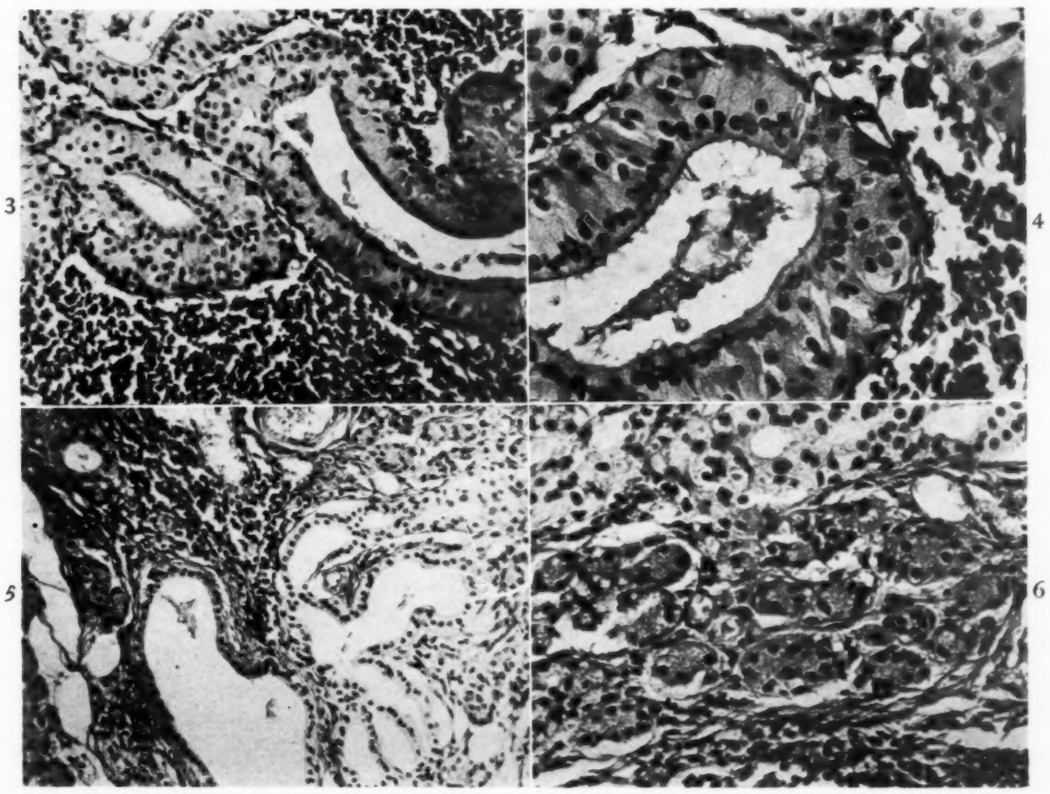

Fig. 3. General microscopic structure of tumor from left side. This shows characteristic epithelium, lymphoid stroma. × 200.

Fig. 4. High power microscopic appearance of tumor from left side showing outer layer of tall collumnar cells and basal layer of cuboidal cells. × 440.

Fig. 5. Tumor from right side showing a more cystic structure. × 200.

Fig. 6. High power photomicrograph of tumor from right side showing coarse granular appearance of cytoplasm. × 440.

tumor measures about 5.5 cm. across. (Figs. 3 to 6.)

"Microscopic sections from the tumors from both the right and left side show essentially the same picture. The tumors are composed of normal appearing, well differentiated lymphoid stroma scattered throughout which are numerous glandular and cystic spaces outlined by a double layer of high columnar epithelium. In many of the cysts the epithelium projects in a papillary fashion. The lymphoid stroma lies immediately beneath the epithelium. There is no evidence of malignancy. In one or two regions some normal appearing parotid gland tissue is found around the periphery. Diagnosis: Papillary cystadenoma lymphomatosum."

COMMENT

The etiology and pathology of this tumor have been dealt with completely in the reports previously cited. The clinical features of this case are typical of this type of tumor. It is difficult to distinguish clinically from the more common mixed parotid tumor despite its morphologic entity. Ramage et al. quoted Carmichael and his colleagues with the statement that no record of correct preoperative diagnosis had been made. The cystic tumor in the right neck was diagnosed preoperatively as a branchial cyst and the mass on the left side as a mixed cell salivary tumor.

SUMMARY

1. There were six previously reported cases of bilateral papillary cystadenoma lymphomatosum.

2. A case of bilateral tumors is presented, one of the side having four individual tumors.

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SUBTOTAL CRANIECTOMY FOR OSTEOMYELITIS OF THE SKULL*

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A CASE of osteomyelitis of the skull exhibited such remarkable pathologic and surgical features that its presentation seems warranted. Two interesting aspects of the case were the tremendous thickening of the skull and the progressive extension of the infection in spite of repeated surgical intervention. Only after almost the entire calvarium had been removed was the process arrested. This was probably a case of mixed infection as represented by the treponema pallida, streptococcus and staphylococcus. The salient features in the clinical picture were a positive reaction to blood tests for syphilis, spontaneous drainage of pus through the upper eyelids, palpable destruction of areas of the skull and striking roentgenologic evidence of sclerosing osteitis.

CASE REPORT

C. L., a forty year old negro woman, was admitted to Charity Hospital in New Orleans on August 20, 1943, complaining of pain and swelling in the head, protrusion of the eyes and severe headache.

In March, 1943 the patient began to experience dizziness when she moved. In May, 1943 small swellings appeared in the region of the upper eyelids. These ruptured spontaneously and pus escaped from them at irregular intervals. These abscesses were accompanied by severe frontal headaches and the patient's eyes were said to have protruded. Previous to her admission to the hospital the patient had consulted a physician who evacuated a great deal of pus when he reopened the lesions. Two weeks prior to admission she had two attacks of "dizziness," each of which caused her to fall.

The physical examination revealed an undernourished negro woman with an enlarged and asymmetrical head. There was slight exophthalmus and the eyelids were edematous. Examination of the forehead disclosed a round, swollen, fluctuant area on the right side which was 4 cm. in diameter. Palpation suggested a defect in the underlying bone. A smaller defect was palpated on the left side of the forehead. The upper lids were marked by crusted areas from which pus could be expressed. There was neither pain nor tenderness. In addition to these lesions there were two fluctuant areas, one on each side of the midline just behind the hair line of the forehead. The pupils reacted to light and accommodation. The extra-ocular movements and the ocular fundi were normal. Vision was approximately normal. A 4 plus reaction to the Kline test was reported. Staphylococcus aureus was obtained by culture of the pus.

FIG. 1. The destructive osteomyelitis appears to be limited to the frontal bone but the remainder of the cranial vault is thickened.

Roentgenograms of the skull showed areas of destruction and sequestration in the frontal bone; the skull was greatly thickened. (Fig. 1.)

After a brief course of antisyphilitic therapy and sulfathiazole a neurosurgical consultation was requested on September 1, 1943. The diagnosis of mixed syphilitic and pyogenic

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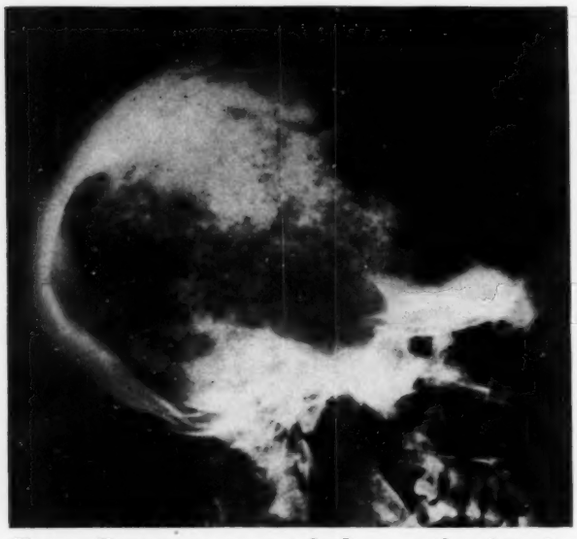

Fig. 2. Roentgenogram made five months after the one shown in Figure 1. Osteomyelitis has spread to involve the rest of the cranial vault.

Fig. 3. Roentgenogram of the skull made after final operation. Little of the cranial vault remains.

osteomyelitis of the skull was accepted and operation was performed on the following day.

Under local anesthesia a coronal incision was made just behind the hair line from the right temporal to the left temporal regions, and the scalp and periosteum were retracted forward to the supra-orbital ridge. Defects in the outer table of the skull and considerable amounts of pus were noted. A trephine opening in apparently healthy bone was made and the greater portion of the frontal bone was removed with rongeur and Gigli saw. In the midline the bone measured 2.5 cm. in thickness. Both frontal sinuses were cleaned out and their openings into the nasal cavity were enlarged. A rubber tissue drain was brought out through each end of the incision and the scalp was loosely closed with silk sutures. Examination of the culture made at operation revealed the presence of anaerobic streptococcus, Staphylococcus albus and saprophytes.

After administration of sulfathiazole for three weeks there was almost no drainage from the wound but on September 30th, only four weeks after operation, roentgenograms showed areas of osteomyelitis in the parietal bones. On October 4, 1943, the patient exhibited a septic fever and there was an increase in drainage from both ends of the incision. Antisyphilitic treatment was resumed on October 5, 1943.

The second operation was performed on October 7, 1943. Under endotracheal anesthesia a saggital incision was extended backward from the coronal incision for a distance of about 7 cm. and the coronal incision was reopened. A considerable portion of the parietal bones was removed. The scalp was closed around rubber drains.

On October 11, 1943, the patient's temperature was normal and seven days later she was ambulatory. By November 17, 1943, the incision had healed completely except for a small granulating area in the left temporal region. The patient was discharged on November 18, 1943.

The patient returned to the hospital on February 12, 1944, because of severe frontal headaches which seemed to "push her eyes out." She also continued to have attacks of dizziness and on one occasion lost consciousness for an unknown period of time. For three weeks prior to this admission she had had fever and chills three or four times daily. A roentgenogram of the skull made on the date of this admission showed extensive osteoporosis and areas of destruction of the remaining portion of the cranial vault. (Fig. 2.)

At the third operation on March 9, 1944, the saggital incision was extended to the external occipital protuberance, and a second coronal incision was made in the posterior parietal area. The remaining portions of the parietal bones and much of the squamae of the temporal bones were removed by rongeur and Gigli saw. The piece of bone removed with the saw measured 18 cm. by 10 cm. As far as could be determined at the end of the procedure all the infected bone and a considerable margin of healthy bone had been removed. A large epidural abscess and numerous sub-

periosteal abscesses were encountered during the operation. Drains were inserted and the scalp was closed. The postoperative course was uneventful.

Roentgenograms on March 25, 1944, showed that the remaining portions of the occipital and temporal bones were infected.

At the fourth operation on April 6, 1944, the incisions over the posterior part of the scalp were reopened and extended. The squamae of the temporal bones were rongeured away down to their petrous portions. The occipital bone was removed to and including the posterior margin of the foramen magnum. Postoperative roentgenograms showed that most of the cranial vault had been removed. (Fig. 3.) The wound healed so rapidly that the patient was discharged on April 11, 1944, the fifth postoperative day; she was referred to the out-patient clinic of Lafayette Charity Hospital for further antisyphilitic treatment.

On August 11, 1944, four months after the final operation, the patient was reexamined by one of us. She looked well and had no complaints. Her weight had increased from 85 to 120 pounds. The scalp and periosteum seemed to form an adequate support for the brain. The relative softness of her head seemed to give her some amusement.

On December 2, 1944, the patient was admitted to Lafayette Charity Hospital where she died the next day of pneumococcic meningitis. Necropsy showed an extensive, greenish-white exudate over the entire surface of the brain.

COMMENT

This case is presumably one of both syphilitic and pyogenic osteomyelitis of the skull. It presented, in addition to necrosis and abscess formation, a thickening of the bones of the skull which measured 2.5 cm. in one area. At these thickened sites the bone showed the solid structure of cortical bone without a diploic layer. Thickened areas alternated with spots of necrosis, large sequestrums and abscesses. The pathologic picture resembled both the acute and chronic forms of osteomyelitis of the skull as described by Mosher.[1]

As far as we know the cranial vault has never before been so extensively removed. It is remarkable that the absence of a cranial vault did not disturb the patient in any way. Her head was soft but the brain seemed well supported by the greatly thickened dura, periosteum and scalp. It is also noteworthy that the only thing that limited extension of the infectious process was its approach to the bones of the base of the skull. The fatal pneumococcic meningitis which appeared after more than six months of good health probably bore some relationship, although an obscure one, to the craniectomy.

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TRAPPED FECALITH IN CECAL HAUSTRATION WITH LOCAL NECROSIS*

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OWING to the haustrations, the folds and the valvuli, the anatomic structure of the cecum is such, in certain individuals, as to favor the trapping of fecaliths. Such fecaliths, being unable to escape, become larger and may ultimately produce pressure necrosis of the cecal wall.

Presented herewith is the history and findings of such a case wherein a fecalith was found trapped in a haustration of the cecum by the valves and folds, with a resulting pressure necrosis of a small segment of the wall of the cecum.

CASE REPORT

A white male fifty years of age entered the hospital on December 20, 1945, complaining of severe pain in the right lower quadrant of the abdomen. The pain began in the epigastrium two days prior to admission to the hospital and at that time was dull and aching in character. Several hours after onset the pain shifted to the right lower quadrant. The patient felt slightly nauseated but did not vomit. He consulted a doctor who advised immediate hospitalization. On the day of admission to the hospital the pain had become much more severe. The patient gave no history of diarrhea and had not noticed any blood or pus in his stools. There was no history of previous similar attacks and the patient felt perfectly well up to the onset of his present illness.

Physical examination revealed a well developed and well nourished male who was obviously acutely ill. The temperature on admission was 99.4°F. and the pulse was 90. There was no evidence of jaundice; the chest findings were essentially within normal limits; the blood pressure was 124/80. The abdomen was slightly distended and there was moderate tenderness to pressure in the right lower quadrant, especially at McBurney's point. The right rectus muscle was slightly spastic, especially in its lower half. No masses could be felt. The liver, spleen and kidneys were not palpable. There was no tenderness to percussion over the kidney areas. On rectal examination there was moderate tenderness to pressure in the right side of the pelvis. Urinalysis was physiologic. The leukocyte count was 16,850, with a differential count of 80 polymorphonuclears and 10 lymphocytes. The hemoglobin was 89 per cent. A diagnosis of acute appendicitis was made and immediate surgery was recommended.

At operation the appendix was found to be normal and the distal portion of the ileum was normal. On the anterior surface of the cecum, at about the level of the ileocecal junction, an area of necrosis was noted which measured about 1½ cm. in diameter. This area of necrosis was very thin and was about to perforate. Surrounding the necrotic area there was a rim of inflamed, thickened cecum which measured about 2 cm. in width. Beneath the necrotic area there was palpated within the cecum a round, firm body about 2 cm. in diameter. Examination of the remainder of the cecum revealed no further pathologic condition and the appendix was removed. The necrotic area of cecum was excised and a segment of the inflamed rim was removed and sent to the laboratory for histopathologic study. On further examination the firm body felt previously was found to be a hard, black and brown fecalith. This was trapped in a pocket formed by a haustration and the valvuli coli and was unable to escape thereby producing localized pressure necrosis. There was no evidence of a diverticulum. A mushroom catheter was then inserted into the cecum and was brought out through the wound. The catheter was fixed in

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the cecum by means of two purse-string sutures.

Convalescence was smooth. The catheter was removed from the cecum on the sixth postoperative day in order to permit the cecostomy to close. During convalescence a barium enema was given which revealed no abnormality of the colon, other than the findings in the cecum which were due to the cecostomy. Proctoscopic examination revealed no pathologic disorder and stool examination showed no evidence of ova or parasites. The pathologist's report gave the diagnoses of gangrene of the cecum and atypical fecalith.

The patient was discharged from the hospital before the cecostomy had closed and was instructed to return after a period of four months for further check-up. Upon his return a repeat barium enema was accomplished and this revealed essentially the same findings as on the previous examination, with the exception that the opening at the cecostomy site was about the size of a pin head.

SUMMARY

The haustrations, folds and valvuli of the cecum make the anatomic structure of this organ, in certain individuals, of such a character as to favor the trapping of fecaliths.

The history and findings of a case wherein a fecalith was found trapped in a haustration of the cecum by the valves and folds, with a resulting pressure necrosis of a small segment of the wall of the cecum has been presented.

On the basis of experimental studies, Davis et al. believe that this antibiotic is a very helpful adjunct to surgery. In large enough doses it prevents perforation and gangrene of the devascularized bowel by controlling bacterial growth in said bowel wall. The authors believe this antibiotic is especially indicated in intestinal obstruction due to acute embolism or thrombosis of the mesenteric artery. (*Richard A. Leonardo, M.D.*)

PSEUDOHERMAPHRODITISM*

REPORT OF TWO CASES IN THE SAME FAMILY

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THE term "hermaphroditism" originated in Greek mythology. According to the myth, the child of Hermes and Aphrodite showed male as well as female physical characteristics and was given, therefore, the name Hermaphrodita. That name has been applied ever since in medicine to individuals exhibiting certain features of both sexes in their physical appearance. True hermaphroditism is exceedingly rare in human beings and implies that the individual has both types of sex glands. The occurrence of hermaphroditic sex glands or ovotestes has been observed; secondary sexual characteristics in such persons may dominate in either sense and result in a peculiar combination of masculine and feminine traits. Much more common is the condition of "pseudohermaphroditism" in which the external genital organs and the psychophysic attributes are contrary to the sex glands and imitate more or less the opposite sex. It is assumed that the female sex in the human race is homogametic and the male sex heterogametic. The human ova contains the sex factor X. Spermatozoa carrying the X factor and impregnating the ovum produce a female individual with the genetic formula XX; spermatozoa containing the X factor besides the allelomorphic chromosome Y and impregnating the ovum produce the male constitution which is designated by the genetic symbol XY.

The formation of male or female sex glands is normally associated with the development of the homologous secondary genital organs and psychophysic properties. If, however, a *dissociation* of the inherited sexual constitution takes place in embryonic life, the following developmental abnormalities may result: (1) The sex glands belong to one sex and the external genital organs or secondary psychophysic characteristics to the other. The anomaly is termed male or female pseudohermaphroditism according to whether the person has testes or ovaries. We speak of *complete* pseudohermaphroditism when the sexual glands belong to one sex and the external genitalia to the other. Various combinations may occur since the dissociation may take place in the entire sphere of physical and mental make-up. The sex glands and secondary sexual traits may belong to one sex and the external genital organs and psychical inclinations to the other sex; or all internal and external genital organs may be homologous and the secondary sexual properties be those of the opposite sex. Borderline cases may manifest themselves in unilateral gynecomastia or unilateral development of masculine growth of hair on the chest.* (2) The dissociation of the inherited sexual constitution predominantly affects the psychic sphere and inverts sexual inclinations toward the same sex. Thus we arrive at a basic conception of genuine *homosexuality*. The sex glands and external parts belong to the same sex. On the other hand, many peculiar physical proportions have been found in homosexual individuals which more or less resemble those of the opposite sex. No sharp line separates the homosexual group from the hermaphroditic one. Zondek advanced the theory that the normal correlation between sex hormones

* Quoted from H. Zondek's Diseases of Endocrine Glands.

* From the Pathologic Department, St. Mary's Hospital, Madison, Wis.

and nerve centers is congentially disordered and that the cerebral centers react to the hormonal stimuli in an abnormal manner, creating perverted sexual impulses. Cases of acquired homosexuality due to a structural abnormal sex gland or toxic personality changes, such as occur in cocainism, have to be separated from the genuine form. (3) The sex glands and secondary sexual characteristics belong to the same sex but the accessory genital organs do not reach full maturity and remain at a hypoplastic level. This condition constitutes so-called sexual infantilism.

The classification of a pseudohermaphroditic individual as male or female is placed anatomically and medicolegally on whether or not the subject has male or female gonads. Such a criterion has the advantage of clear differentiation but is, nevertheless, an arbitrary standard from a one-sided viewpoint which does not cope with the problem of placing the patient properly in family, social and occupational relationship. In many cases the stigma of a hermaphrodite as male or female according to the sex glands runs contrary to the external appearance and the sexual and social inclinations of the person in question. The approach from a personalistic psychologic standpoint and the consideration of the total psychophysic pattern seems to be a better way for the practical purpose of a happy adjustment of the patient. These facts are illustrated by the following cases:

Case 1. A white girl nineteen years of age and having seven adult sisters of normal development plus one younger "sister," was hospitalized because of a sudden attack of pain in left inguinal region, nausea, vomiting and headache. She had a small inguinal hernia since the age of eight. Whenever the patient strained herself by lifting or running, a small hernia about the size of a walnut would appear which she reduced herself. Upon admission a diagnosis of incarcerated hernia was made and a herniotomy performed. The hernial sac contained an encapsulated tumor nodule 2.5 cm. in diameter (Fig. 1) which was firm in consistency, presented a brownish-yellow cut surface and was connected with a large blood vessel running through the internal ring into the abdominal cavity. Histologic examination of the herniated nodule (Figs. 2 and 3) showed a pronounced testicular pattern. The glands resembled well differentiated seminiferous tubules in lobular arrangement but without any evidence of active spermatogenesis. A pathologic diagnosis of testicular adenoma was made.

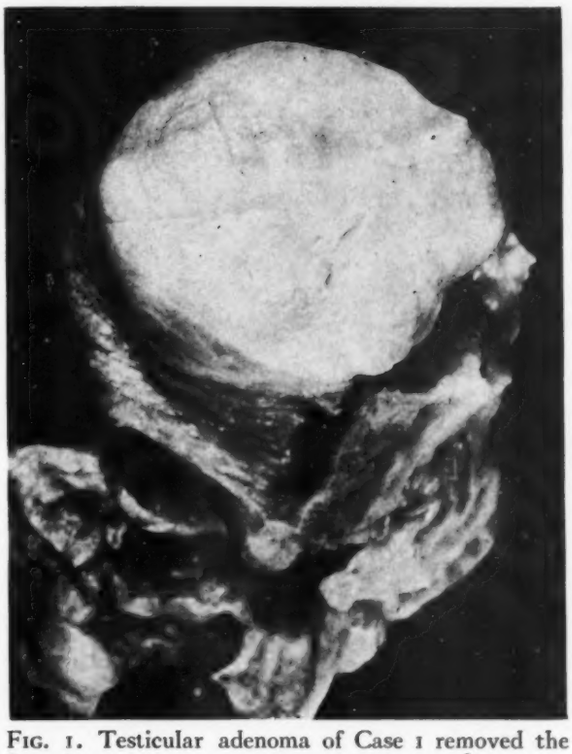

Fig. 1. Testicular adenoma of Case 1 removed the first time.

Physical examination of the patient (Figs. 4 and 5) revealed a general feminine body contour, face expression and fat distribution but a complete absence of axillary and pubic hair. The breasts were well developed. The vulva was infantile with poorly developed major labia. The clitoris was not enlarged. The vaginal opening admitted the middle finger and the vagina was short and narrow; portio vaginalis could not be visualized with a speculum. Vaginal smears stained by the iodine vapor test for estrogen evaluation showed glycogen deficiency of the epithelial cells. The patient had never menstruated in her life but was attracted sexually by males and desired eventual marital relationship.

About six months after the herniotomy the patient consented to an exploratory laparotomy for clarification of her endocrine status. A small

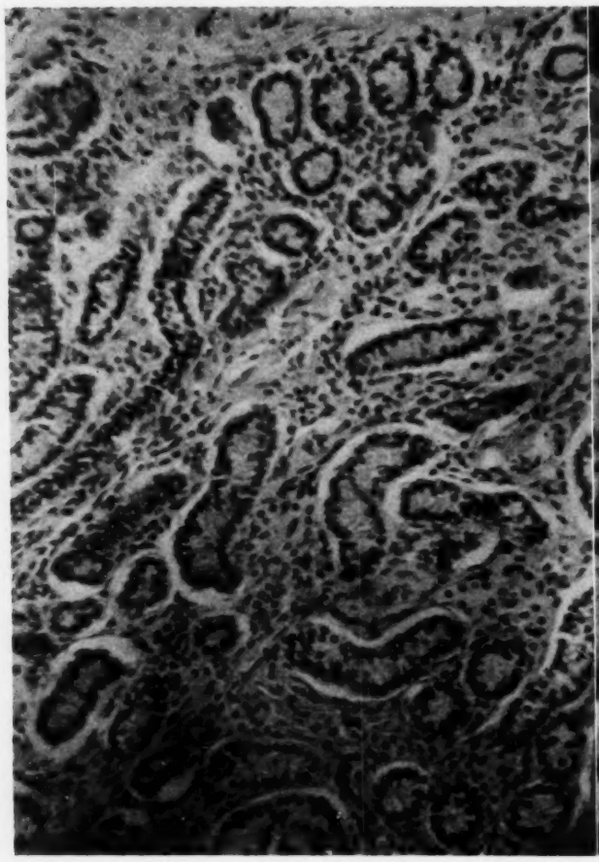

Fig. 2. Low power magnification of section of testicular adenoma, Case 1.

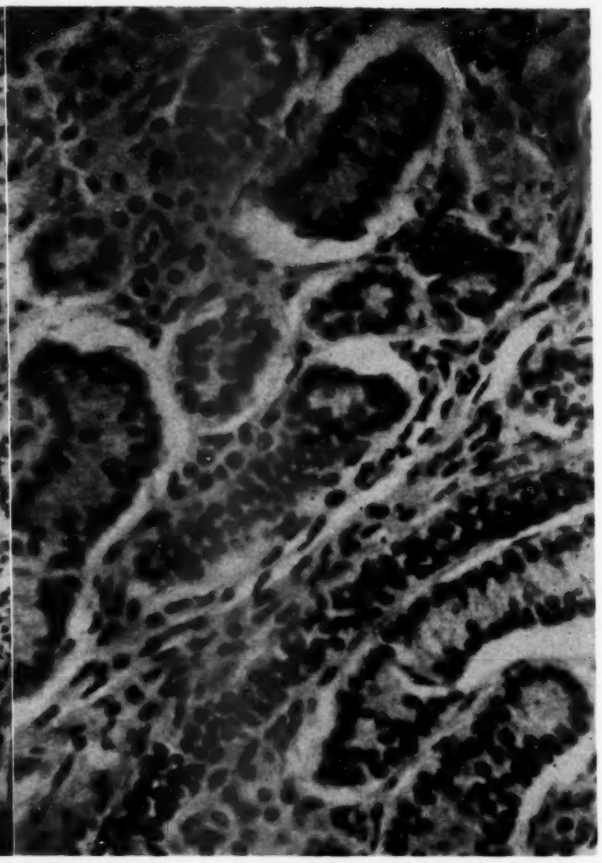

Fig. 3. High power view of section from testicular adenoma.

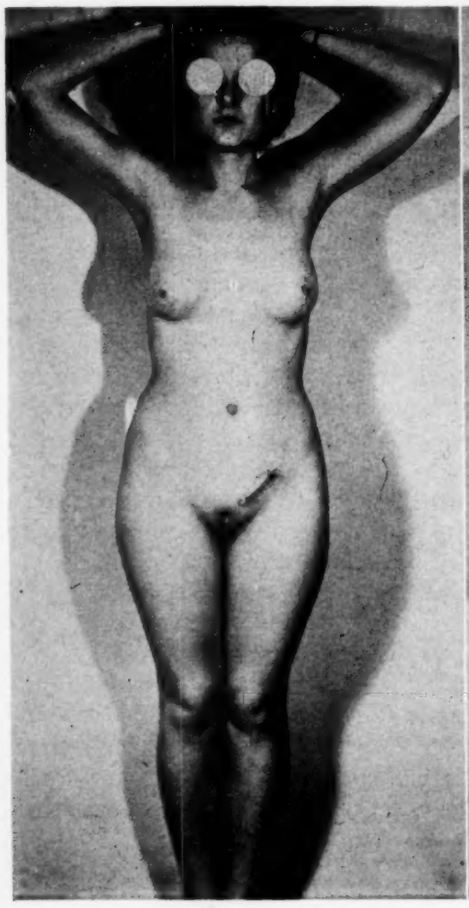

Fig. 4.

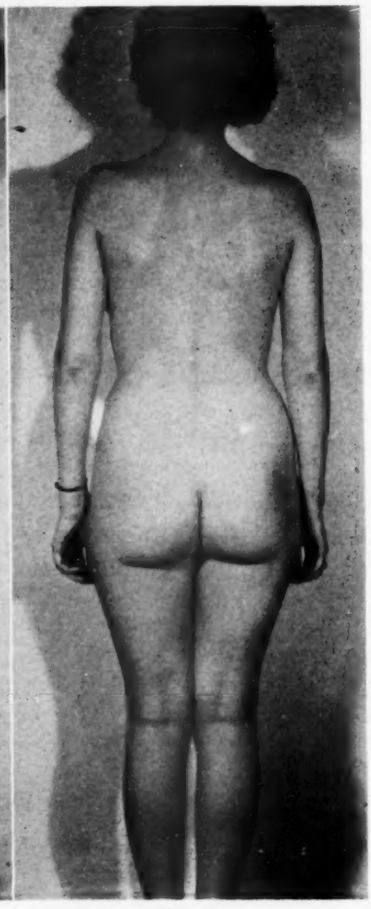

Fig. 5.

Figs. 4 and 5. Case 1.

Fig. 6. Undescended right testicle, Case I.

undescended testicle (Fig. 6) was found in front of the right internal inguinal ring which on cross section included three small adenomas resembling the nodule removed at the first operation and being identical in microscopic structure. There was complete absence of uterus, tubes and ovaries as well as prostate and seminal vesicles. In view of the general feminine physical and psychic make-up, the sexual inclination of the patient and the impossibility to promote development in a masculine direction it was decided to remove the testicle and to permit the patient to live the rest of "her" life as a female. It was believed that this would be in line with the predominance of female attributes in her total psychophysical personality. The anatomic diagnosis, of course, had to be that of a male pseudohermaphrodite.

Case II. This patient was the younger "sister" of the patient in Case I and was twelve years of age. (Fig. 7.) She was brought up as a girl and acquired feminine traits through environmental influence. However, she showed a boyish facial expression, male hair line on forehead, hairy film on upper lip, broad

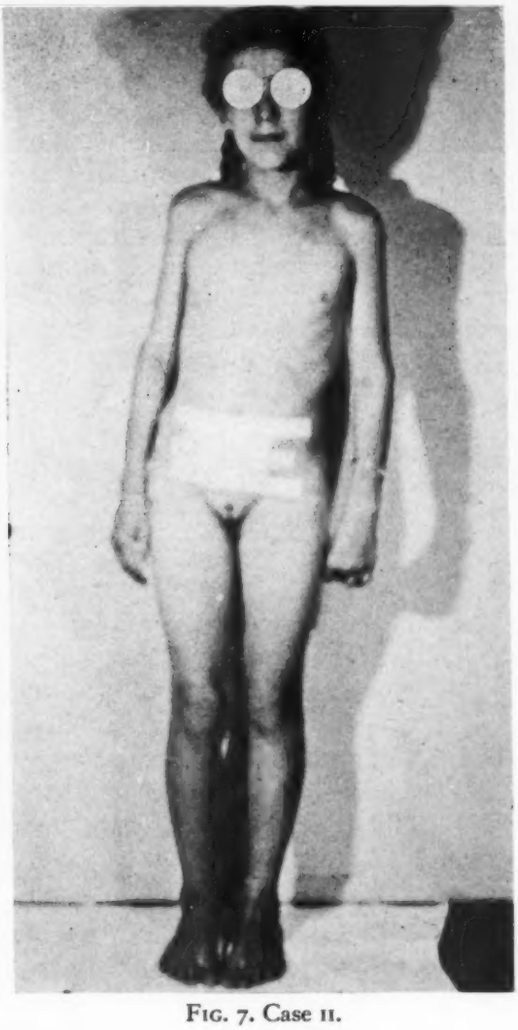

Fig. 7. Case II.

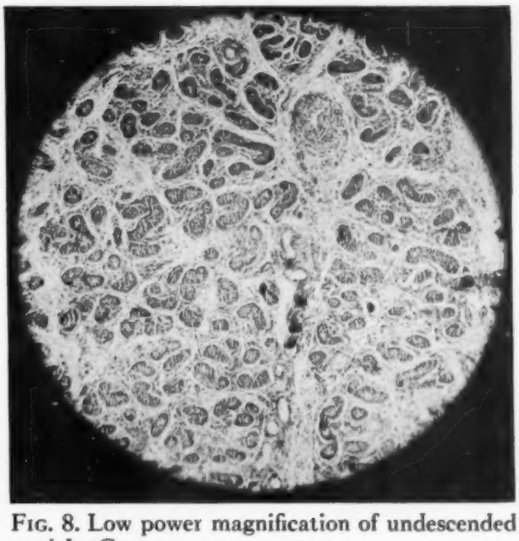

Fig. 8. Low power magnification of undescended testicle, Case II.

wrists, and flat nipples but normal female external genitalia corresponding to her age. She had a reducible right inguinal hernia for a long time. Consent for an exploratory operation was obtained under the suspicion that the child may have had the same abnormality as her older "sister." This expectation was confirmed by the finding of an undescended testicle (Fig. 8) in the inguinal canal; the other testicle was located at the left internal inguinal ring. There was no evidence of uterus, tubes or male accessory organs. Both testes were removed and a diagnosis of male pseudohermaphroditism was made.

SUMMARY

The problem of pseudohermaphroditism was discussed from a general anatomic, genetic and clinical standpoint. Two such cases in the same family were described as to clinical and anatomic findings.

Pedersen and Kenyon report a case of Cushing's syndrome in which a marked fuchsinophilic staining reaction of the surgically extirpated half of the enlarged right adrenal gland (found on exploratory operation) was the only positive pathologic finding present. After surgery the patient was given x-ray therapy to his pituitary gland and he was improved by this combined therapy (these are rare but interesting cases). One may suspect this syndrome when a woman develops rather sudden and painful obesity, especially of face, neck and trunk, early amenorrhea, increased growth of hair on face and body, diminished sugar tolerance, etc. (*Richard A. Leonardo*, M.D.)

Bookshelf Browsing

TODAY, YESTERDAY AND TOMORROW IN OBSTETRICS

ALFRED C. BECK, M.D.*
Brooklyn, New York

ANNUAL reports of the obstetrical division of the Long Island College Hospital are quite like those of similar services. A brief survey of some of the statistics therein contained may be taken as representative of the obstetric end results of today. (Table I.) During the years 1945 and 1946, 3,360 women were delivered of children in that institution. Of these, three or 1 in 1,120 died, a maternal death rate of approximately 8.9/10,000 births. Among the 3,624 women who were admitted to the service, four had eclampsia and none of these died. The eclampsia incidence accordingly was 1 in 906 admissions. Of the 3,335 infants weighing 1,000 Gm. or over at birth, forty-four were stillborn and twenty-seven died in the neonatal period. The infant mortality including all prematures over 1,000 Gm., therefore, was 2.1 per cent. (Table II.)

TABLE I
LONG ISLAND COLLEGE HOSPITAL
MATERNAL END RESULTS 1945 AND 1946

Admissions	3,624
Deliveries	3,360
Deaths	3 or 1 to 1,120 deliveries
Eclampsias	4 or 1 to 906 admissions

TABLE II
LONG ISLAND COLLEGE HOSPITAL
INFANT MORTALITY 1945 AND 1946

Infants over 1,000 gm	3,335
Stillbirths	44
Neonatal deaths	27
Total deaths	71 = 2.1%

One who has followed obstetric thought for the past thirty-five years, as the author has, cannot observe this low maternal death and this low infant mortality rate without recalling the relatively poor end results which prevailed at the beginning of his obstetric career. When the writer entered the field of obstetrics, about one in every one hundred women delivered in our hospital died and over 6 per cent of the infants were lost. Eclampsia occurred once in every one hundred pregnancies and 20 to 25 per cent of the women so afflicted died. Women suffering from virulent puerperal infection were always on our service and hemorrhage of a serious nature was frequently encountered.

Although obstetric theory at that time was much as it is today, obstetric practice, at least from the standpoint of the community, was quite different. A few skillful obstetricians were then practicing in Brooklyn, but their number was small in comparison with the number who are doing fine obstetrics today. Of necessity most of the deliveries were conducted in the homes by general practitioners and midwives. As the number of hospitals with maternity services was small in relation to the total population the facilities for teaching practical obstetrics were limited. These practioners had to learn the practice of obstetrics from their own experience. They thus learned by their mistakes at the expense of their patients.

Many of these men had entered practice directly after graduating from medical school without the advantage of an internship, their only experience having been the

* Address of the guest speaker at the Joint Meeting of the Philadelphia, New York and Boston Obstetrical Societies held in Boston, April 15, 1947.

attendance at the six deliveries which were required by the State Licensing Board. In such circumstances the few well trained obstetricians who were available were kept busy as consultants. Unfortunately, these consultants often were called only after the patient's condition had become critical. As a consequence major operative procedures of a last resort nature frequently were required and even these, at times, failed to save the patient. In other words, the system then in vogue furnished woefully inadequate care for the average woman during pregnancy and labor but provided a few well trained obstetricians to act as consultants and rake the chestnuts out of the fire for their incompetent colleagues. Although the idea that the chestnuts might have been prevented from falling into the fire had already begun to dawn, there were no prenatal clinics until the first one was established in Brooklyn in 1912.

Even after our prenatal clinic was established most of the women delivered in our institution had had no prenatal care. They were either brought in by ambulance or were sent to the hospital by their physician or midwife after labor had been in progress for some time. I recall that it was extremely difficult and often impossible to make the women in our district understand the value of careful supervision during pregnancy. In fact, our clinic was more or less of a failure until we refused to accept cases for home delivery by our out-patient department unless they had attended the prenatal clinic. How different the situation is in this respect today! Thanks to maternity centers and other educational agencies it no longer is necessary to coerce women into accepting prenatal care. Most of them will not engage a physician for delivery unless he also includes this service.

Because of the lack of proper supervision during pregnancy and the early part of labor, the risk from cesarean section was great. Women with borderline contraction of the pelvis were given a thorough test of labor before interference was considered. Their labor was allowed to continue until the cervix was fully dilated and several hours of good second-stage pains proved that the head would or would not enter the pelvis. If engagement failed to occur, the child frequently died before the test was completed and a craniotomy was done. If it was alive at the completion of the test and the head failed to enter the pelvis, it was delivered by cesarean section with the result that many of the mothers so treated died. Destructive operations accordingly were common and the members of our staff became skillful in their performance. Here again our practice at present is quite different. We now recognize dystocia early in labor and deliver such patients by cesarean section within the period which is safe for suprapubic delivery. The need for destructive operations is now so rare that we are unable to train residents adequately in the use of these procedures.

Eclampsia in those days was encountered about once in every one hundred admissions and probably was the most baffling of all the serious obstetric complications. Its frequent occurrence together with its high mortality of 20 to 25 per cent kept down the conceit of all obstetricians. While a man might have had the good fortune to get away with several successive cesarean sections on infected women, his luck always deserted him when he was called upon to treat eclampsia. The treatment of this condition at that time was so different from its present treatment that a brief description of the routine commonly employed in the old days may be of interest. The patient having one convulsion after another was wheeled into the delivery room. After taking a catheterized specimen of urine to confirm the diagnosis, preparations for immediate delivery were made regardless of the mother's general condition. Since the living products of conception were thought to be the cause of eclampsia, the removal of the child was our first consideration and took precedence over every other therapeutic measure. Whenever the cervix was sufficiently dilated, this was accomplished by forceps or

version and extraction. If the cervix was not sufficiently dilated, it was first opened by means of a vaginal hysterotomy, Dührrsen's incisions or manual dilatation under general anesthesia. If the critically ill patient survived this hasty and traumatic delivery, she was subjected to the most inhuman eliminative measures. An intern inserted a stomach tube and began a gastric lavage while a nurse inserted a rectal tube and started the inevitable 20 gallon colonic irrigation. Following the gastric lavage, croton oil and castor oil or magnesium sulfate were left in the stomach. An attempt was then made to induce sweating by wrapping the patient in large, wet blankets wrung out of hot water, the so-called hot wet packs. As soon as one of the attendants was free he started a phlebotomy or gave veratrum viride. Although sedation was not considered an important part of the treatment, chloral hydrate and morphine were sometimes given. The student spectators who looked on while the nurses and doctors performed their various tasks often likened the spectacle to a three ring circus in which so much was going on at one time that much of it was missed. As I look back I often wonder how any of those eclamptic patients survived the treatment much less the disease.

Thirty-five years ago women were allowed to suffer throughout most of their labor. Only during the latter part of the second stage was relief of pain attempted by administering chloroform during each uterine contraction. Today relief of pain is one of the chief considerations of all obstetricians and most women are relieved of most of their pain with safety. While I was still a resident, the twilight sleep frenzy descended upon our clinic as it did upon many others. The fact that a woman could sleep throughout her labor and awaken after the child was born with no recollection of any suffering had a great appeal. Women in general became enthusiastic about the method and demanded its adoption by the medical profession. Although this method of securing analgesia and amnesia proved less safe than it was hoped, it contributed toward the advancement of obstetrics in several ways.

Because of the close observation required and the seemingly miraculous end result obtained in most cases, the public came to regard the obstetrician in a new light. Instead of looking upon him as an idle bystander who patiently stood by while nature did its work, he was regarded as one who worked wonders in every patient he attended. Thus obstetrics was clothed with a new dignity which approached that which invested surgery. The greater appreciation of and the increased demand for good obstetrics thus engendered encouraged many young men to seek adequate training in obstetrics.

While the use of morphine and scopolamine according to the twilight sleep routine was found to be unsafe and was abandoned by most clinics, the value of these drugs was clearly demonstrated with the result that their continued use within the limits of safety has relieved much of the pain of childbirth. Even though it was ultimately abandoned the twilight sleep movement must be credited with having given a new and strong impetus to the search for an ideal method of pain relief, a search which has borne much fruit and continues to do so to this day.

Finally it may be said that even though its main objective, the complete elimination of pain without risk, was unobtainable the twilight sleep propaganda focused the attention of women in general upon the entire subject of maternal welfare, and thereby brought new and vigorous support from without to those obstetricians who were crusading for better obstetrics.

Within a short time after its establishment, the prenatal clinic demonstrated its value and the end results in the patients that entered the hospital from this source were excellent. On the other hand, neglected patients from the outside continued to be admitted and the poor outcome in many of them kept our gross maternal and fetal mortality high. This division of our

patients into two classes fostered the development of a peculiar two-sided attitude in us, in that we accepted full responsibility for the good results in our prenatal clinic subjects but refused to share the blame for the poor results in the others. We thus were quite well satisfied with ourselves and believed that we were doing all that could be expected of us. Unfortunately, a similar narrow attitude seemed to prevail in all of the clinics with which I was familiar. This complacency, however, was severely jolted in 1919, when the Children's Bureau of the Department of Labor published a pamphlet which showed that the maternal death rate was higher in the United States than in almost any other country. (Fig. 1.) The contrast between the lower death rate of 2.5/1,000 in Sweden and our high rate of 7.3/1,000 was emphasized, and Sweden was held up before us as a paragon of efficiency.

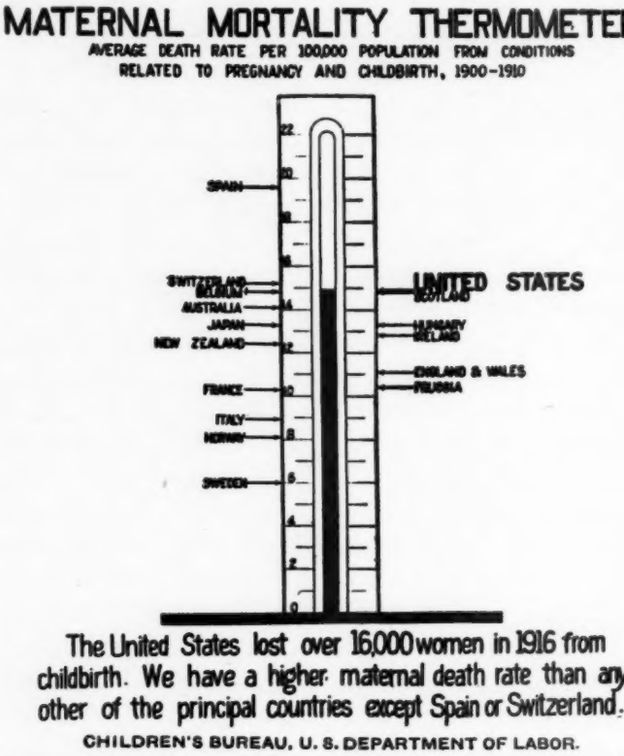

Fig. 1. Maternal death rate per 100,000 population in the United States compared with that in other countries. (Children's Bureau, U. S. Department of Labor.)

Prominent obstetricians everywhere rushed to the defense of the American system or, shall I say, lack of system. They claimed that the data from the other countries should not have been compared with ours because of the lack of uniformity in the methods of assembling mortality statistics. Holding that our figures included all deaths from abortion, extra-uterine pregnancy and intercurrent disease while those of many other countries did not, these men denounced their critics for introducing superficial and untrustworthy evidence to defile the good name of American obstetrics. Even Dr. DeLee, who always was a crusader for better obstetrics in this country, made the statement that anyone who claims that the United States is sixteenth or eighteenth in the list of countries in maternal mortality is guilty of treason. The critics, on the other hand, contended that the midwives in Europe were well trained and under the supervision of the state, and that their practice accordingly had been made safe for the mothers and babies. As a result of the ensuing agitation, Congress passed the Sheppard-Towner Act

in 1921, which made available to the states over $1,000,000 annually for the promotion of the welfare and hygiene of maternity and infancy.

The controversy over the difference between the statistical data of this country and that of other countries led to a more comprehensive survey of the situation by the same Children's Bureau. Investigators were sent out to interview the physicians and midwives who attended all of the women who died from puerperal causes during the years 1927 and 1928 in fifteen states. (Fig. 2.) Under the supervision of an advisory council of well known obstetricians the data furnished by the original death certificates was reclassified with the result that the death rate as determined by this investigation differed but slightly from that which was based upon the original death certificates. According to the original certificates, the rate was 64.1/10,000 live births. This was reduced to 62.7/10,000 by the investigation. Deaths due to abortion and extrauterine pregnancy totaled 5.1/10,000. If these are deducted from the 62.7 figure, the death rate in the fifteen states remained 57.6/10,000 live births. (Table III.)

Similar conclusions were reached by the Committee of the New York Academy of Medicine which investigated the deaths which occurred in New York City during the years 1930, 1931 and 1932. This investigation also showed that 65.8 per cent of the deaths were preventable and that the attending physician or midwife was responsible for 61.1 per cent of these preventable deaths. The work of this committee was a most significant step in the right direction. Instead of defending our end

CHART I.—STATES INCLUDED IN MATERNAL-MORTALITY STUDY

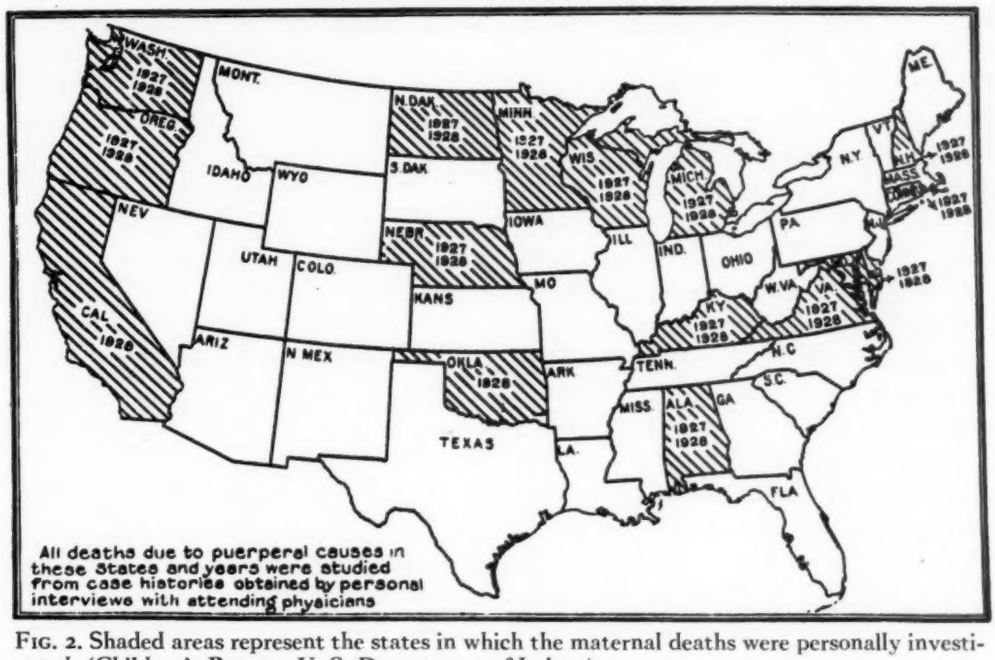

FIG. 2. Shaded areas represent the states in which the maternal deaths were personally investigated. (Children's Bureau, U. S. Department of Labor.)

TABLE III

MATERNAL DEATH RATE PER 10,000 LIVE BIRTHS FIFTEEN STATES 1927 AND 1928

	According to Death Certificate	According to Investigation
From all causes	64.1	62.7
Abortions and ectopics	5.3	5.1
Exclusive of abortions and ectopics	58.8	57.6

results they reported that our death rate was almost three times as high as it should have been and that the physician was responsible for almost two-thirds of the preventable deaths. (Table IV.)

TABLE IV
NEW YORK ACADEMY OF MEDICINE SURVEY
NEW YORK CITY DEATHS 1930, 1931 AND 1932

Total deaths	2041
Preventable deaths	1343 = 65.8%
Physician responsible for 61.1% of the preventable deaths	

Following the publication of the Academy report, various county medical societies throughout the country made monthly surveys of the maternal deaths in their respective communities. The underlying factors in each death were thus brought to the attention of and discussed by the local members of the medical profession. These surveys accordingly served a dual purpose. They supervised the work of all who did obstetrics and at the same time inaugurated a new and excellent method of postgraduate instruction.

About this time a definite drop in the persistently high maternal mortality rate took place and this has continued up to the present. Between 1915 and 1933, the maternal death rate in the registered area of the United States remained above 60/10,000 live births. Since 1929, it has fallen progressively from 69.5 to 22.9 in 1944. (Fig. 3.)

In addition to the changes in the management of contracted pelvis and eclampsia already mentioned, many other advances have been made. Most notable of these were the efficient treatment of syphilis with arsenicals and penicillin, several improved technics for cesarean section, use of blood transfusions and the establishment of blood and plasma banks, substitution of rectal for vaginal examinations, prophylactic episiotomy and outlet forceps, development of x-ray pelvimetry, use of the sulfa drugs and penicillin in infections, discovery of the Rh factor and its application to obstetric practice and finally the various improvements in the methods of pain relief. While these advances have contributed toward the improvement of our obstetric end results, they probably were responsible for only a small part of the progressive fall in the maternal death rate which has been observed since 1929.

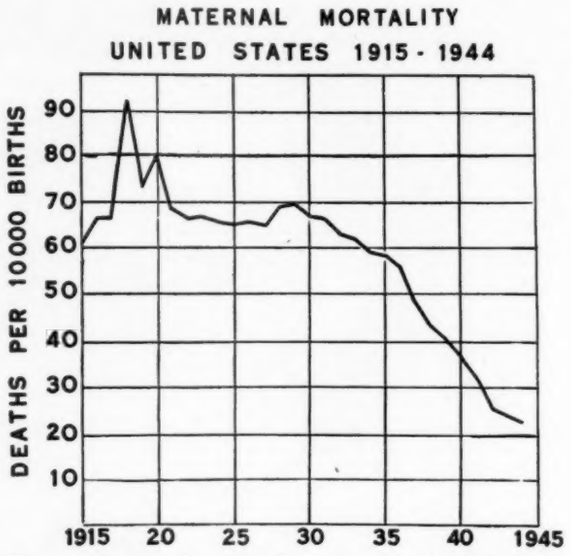

FIG. 3. Curve showing the annual maternal death rate in the United States from 1915 through 1944.

To my mind this improvement in our end results has been due largely to certain other factors. First of all it may be stated that the groundwork for this change was laid back in the twilight sleep days when the demand for better obstetrics began. Because of the lack of good obstetricians and because of the scarcity of maternity beds, this demand was not to be satisfied for many years. Every attempt to satisfy it, however, elevated obstetrics to a higher and higher plane is the estimation of the public and medical profession. As a result the obstetrician and his maternity service were no longer regarded as stepchildren of medicine but became important factors in hospital organization. Instead of being religated to a corner of the building which could be used for nothing else, obstetrics was elevated to the level of surgery and was allotted more and more beds or even furnished with a new and separate pavillion. In 1946, there were 2,136,373 births in hospitals in the United States. In those

institutions which did not provide a separate maternity building the department of obstetrics ultimately was allowed to segregate its patients on a special floor or in a special wing and thus protect the maternity patient against infection by contamination from infected surgical and other patients and their attendants.

Obstetrics also rose to a higher estate in the medical schools. More hours were allotted and better instruction was given. This was particularly true of clinical or practical obstetrics. In most schools each student is now required to spend one or two months in the delivery room and maternity ward. The high regard in which obstetrics came to be held, together with its close affiliation with gynecology, led more young men to seek training in the combined specialities. With the building of more hospitals and the allottment of a greater proportion of their beds to obstetrics, many of these men were able to obtain one year straight internships and a smaller group were afforded the opportunity of serving two, three or even four years as residents. According to the Journal of the American Medical Association, 939 residencies were available in 1946. Some idea of the increase in the number of trained obstetricians may be gained from the fact that over 1,700 physicians were licentiates of the American Board of Obstetrics and Gynecology last year and these men were located in 300 different communities in the country. In other words, these fairly well trained young men, a new generation so to speak, have located in all parts of the country and are beginning to supply the service which the country has needed and the public has demanded for so many years.

At first glance one viewing the maternal and infant mortality figures of today might conclude that further improvement in obstetric practice is impossible. One maternal death to one thousand deliveries must be close to the irreducible minimum. On the other hand, all of us know that preventable deaths still occur in our own localities in which good maternity care is available. Education of the public as to the need for early and special care in cardiac disease, nephritis, anemia and other medical complications, together with better coordination of the various factors which make up our present system of maternal care, should eliminate most of these preventable deaths and make the maternal end results even better than they are today.

While we may point with pride to our low maternal mortality, we may well question the quality of the end results as they are related to the newborn child. Since the premature infants who are too small to live together with the serious congenital anomalies make up over 1 per cent of all newborn infant deaths and since most of us believe that we are not responsible for the occurrence of these groups, obstetricians have come to regard an infant mortality of 2 per cent as close to the irreducible minimum. Our refusal to share responsibility for abortions, premature deliveries and the birth of serious congenital anomalies places us in the same position as were the older obstetricians who refused to share any part of the responsibility for the neglected patients who were sent into the hospital until others outside of obstetrics began to criticize the system for which they were responsible. When one woman of every fifty who carry to viability loses her child and at least one woman of every ten who become pregnant aborts, the end results are anything but good. If we as obstetricians are not responsible for this poor outcome of obstetric practice, who is? Certainly the woman who has no facilities for investigating her misfortune is not. I believe that the obstetricians of tomorrow will accept this responsibility and study the problem of abortion, premature labor and congenital anomalies with a view to bettering our end results of today.

Animal studies have shown that various deficiencies result in abortion or the premature birth of defective offspring, and recent observations have called our attention again to the injurious effect of virus disease on the young embryo. More infor-

mation of this character should lead to better management of the hygiene of pregnancy and thus lessen the number of abortions, premature labors and serious congenital anomalies.

Mall and Streeter, and more recently Hertig and Rock, have demonstrated the high percentage of early ova that are abnormal. These abnormal ova, especially the ones of Hertig and Rock which were obtained before or soon after the first period was skipped, indicate that either the spermatozoon or the ovum might have been defective at the time of fertilization. That this is possible is shown by the large number of abnormal forms that are present when the semen is examined in the course of our sterility studies. Such knowledge indicates that preconceptional advice that may result in improvement of the germ cell is important. These few instances of fruitful research indicate that future reduction of our infant mortality is a fertile field for further study.

X-ray pelvimetry when properly done is so superior to the older methods of pelvimetry that women in the future probably will demand and receive an x-ray investigation of their bony pelvis before they become pregnant. If the obstetricians of tomorrow are less narrow minded than the obstetricians of yesterday, they will assume the responsibility of providing facilities for this purpose in their respective communities. Supervision and proper evaluation of this work will thus remain where it belongs, in the hands of the obstetricians, even though the necessary funds for such a service may have to be furnished by the state or some other agency.

Future consideration should and no doubt will be given to the improvement of obstetric practice in two other important respects, namely, the development of a better method of controlling toxemia and the development of a safe and satisfactory means of making labor an elective rather than an emergency procedure.

While our present system of prenatal care almost completely eliminates the danger of toxemia, this assurance of safety is accomplished only at the expense of great inconvenience to the patient. At present all pregnant women must make monthly, bimonthly and finally weekly visits to their physician in order that the few who are destined to have toxemia may be discovered and given the special care which this condition requires. A better understanding of toxemia probably will enable the obstetrician of tomorrow to devise a more simple means of separating the few who are predisposed to this complication from the many who are not and thus greatly simplify the prenatal routine of the latter.

That our inability to judge just when labor will begin is the cause of much worry and inconvenience to the patient and her physician cannot be doubted by anyone who has practiced obstetrics. For weeks before and all too frequently for weeks after the expected date of confinement the patient and her physician must hold themselves in readiness for the event. If the patient lives some distance from the hospital, it may be necessary for her to spend these weeks of uncertainty in a nearby hotel to avoid the possibility of giving birth to her child in a taxicab. Discovery of the cause of the onset of labor and the invention of a harmless and efficient method of induction would greatly facilitate the adjustment of the time of labor to the convenience of the patient and her physician and thus make childbirth more of an elective than an emergency procedure. Just as most surgical operations are performed at a time of election so too labor would be started at a time which would be most convenient for all concerned.

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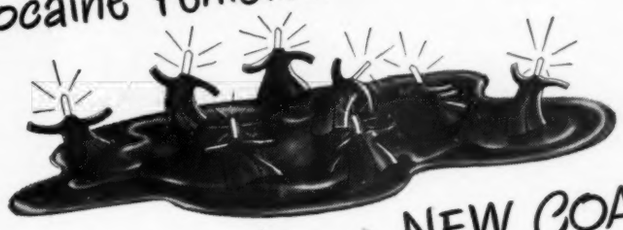

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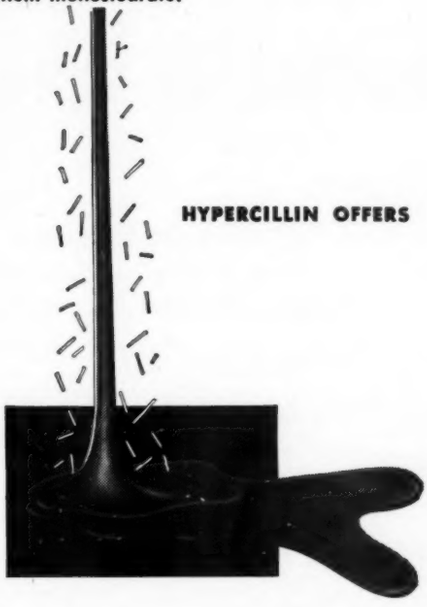

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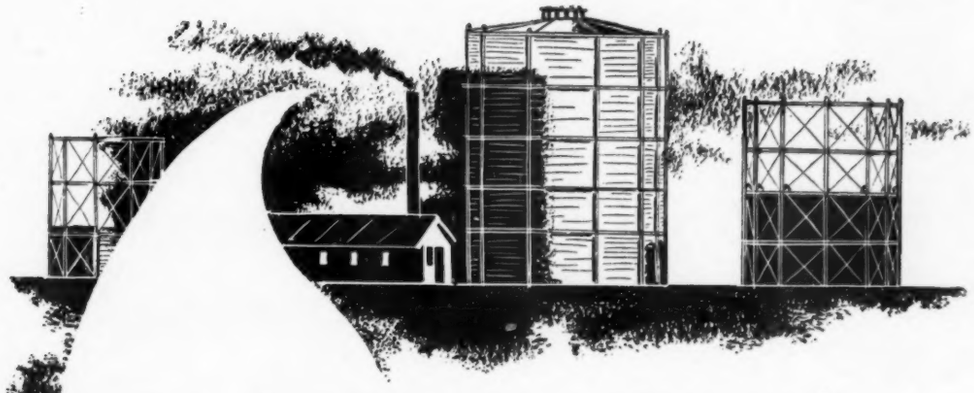

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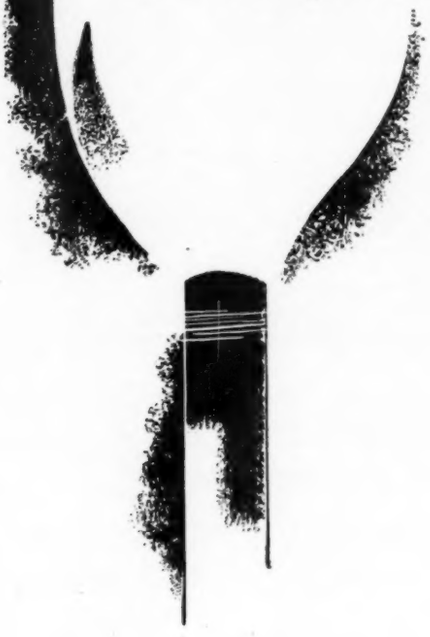

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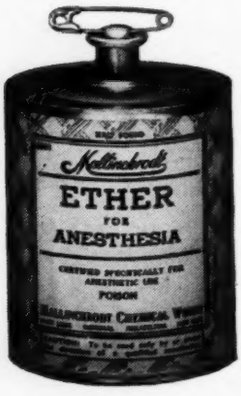

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Mallinckrodt Ether for Anesthesia is supplied in ¼-lb., ½-lb., 1-lb. and 5-lb. cans.

*Habeeb, A., and Elliott, H. R.: Choice of Anesthetic, J. M. A. Alabama, 15: 177-80 (Dec. 1945.)

Mallinckrodt's sound motion pictures, "ADVENT OF ANESTHESIA" and "ETHER FOR ANESTHESIA" are available to medical societies and other professional groups. Write to our St. Louis or New York office for details.

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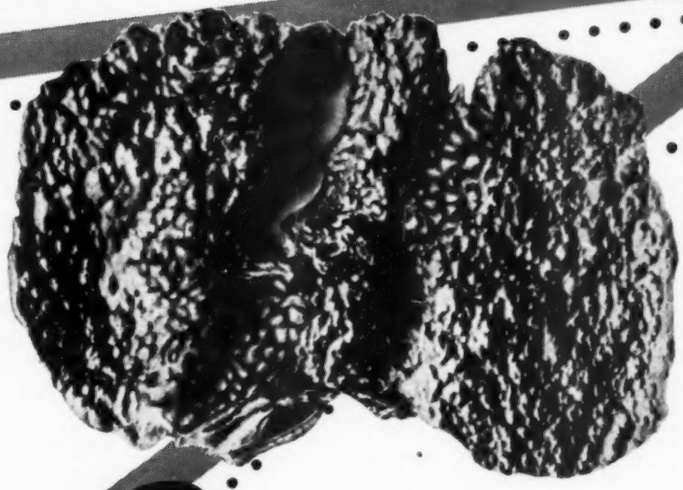

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WHEN instituted early and in conjunction with a diet providing large amounts of protein and B complex vitamins, Choline therapy interrupts the chain of events in the development of portal cirrhosis. Thus fatty infiltration of the liver, the forerunner of cirrhosis, is overcome, and the fatal complicating cirrhosis is either forestalled or prevented.

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The technique developed by Dr. Cooper for the successful treatment of leg ulcers is based upon a 3 point program:

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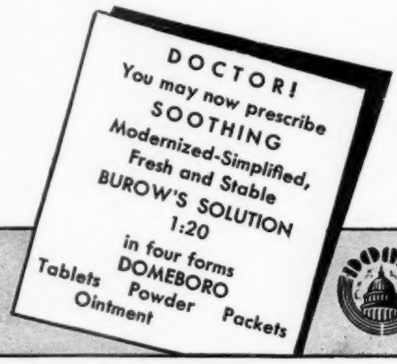
Dome Paste Bandage is a flesh colored, 4" x 10 yd. gauze bandage impregnated with a modified "Unna's Formula" consisting of zinc oxide, glycerine, gelatine and calamine. This Unna's Boot comes to you in a soft condition and is ready for instant use.

Write for samples and literature



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A detail man gets emergency calls, too. Late Sunday night, one of my doctors got me out of bed with a problem in pertussis — needed some Hypertussis* for a desperately sick baby. I got a pharmacist friend to 'open up' his refrigerator — and an hour later that little kid was full of concentrated hyperimmune gamma globulin antibodies!

But here's the punch line! While we were sharing a pot of hospital coffee, that same doctor did ME a favor—by talking about the difficulties of administering multiple 10 cc. doses of unconcentrated serum to infants.

Compared to 10 cc. per injection—it's just simple arithmetic to see how Hypertussis 2.5 cc. reduces dosage volume 75% . . .

10 cc. (unconcentrated serum) = 100%
2½ cc. (Hypertussis globulin) = 25%
Dosage volume REDUCED 75%

Lapin (writing in the Journal of Pediatrics) puts the comparison in clinical terms "...administration of a 10 cc. volume (lyophilized residue of 20 cc. of human serum resuspended in 10 cc. of diluent) is painful. Repetition of this 10 cc. dose at frequent intervals becomes a struggle . . . With a ten fold concentration, the immune bodies of 25 cc. hyperimmune pertussis serum can be delivered in 2.5 cc. of the globulin fraction, in an ordinary hypodermic injection."

→With 10-fold concentration in a 2.5 cc. dose Hypertussis* offers "...by far the most rational therapeutic agent yet used in the treatment of whooping cough." (Silverthorne's statement at the A.M.A. Section on Pediatrics, last year)

The point I'm making these days is—When you have a problem in pertussis—rely on 2.5 cc. Hypertussis*, the Cutter specific blood fraction for whooping cough.

Your DM

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By means of this unique instrument a sheet of skin of uniform thickness may be cut at a predetermined level from any area of the body as large as 4x8 inches (the size of the drum). Some of the many advantages of the improved Dermatome are: Automatic alignment of the knife edge with the drum surface; automatic setting of the knife edge in correct relation to the thickness scale; stronger adhesion of the skin to the drum and when the graft is stripped from the drum, nearly all of the cement remains on the drum. Each part of the new Dermatome is made from material most suitable for that part.

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• Diagnosis is the art or scientific process by which a disease is recognized. Success or failure in establishing a correct diagnosis depends in large measure on the use of reliable, safe and efficient clinical and laboratory procedures.

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Whenever Needed

GOMCO Suction Unit No. 930

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Manufacturers of FINE SURGICAL INSTRUMENTS
83 PULASKI STREET BROOKLYN 6 NEW YORK

Outside the Ivory Tower

(*continued from page 24*)

THE opening of the first Dublin Lying-in Hospital by the obstetrician Bartholomew Mosse took place on March 15, 1745. The land for the later hospital was leased in 1748, the foundation stone laid in 1751, and the wards opened by Mosse on December 8, 1757. These were the origins of the famous Dublin Rotunda, whose two-hundredth anniversary has just been celebrated.

The founding of this great center of obstetric progress was made possible by Mosse's financial acumen. He resorted to lotteries to meet his deficits. This not only enabled him to carry the original venture to success but also made possible the growth of the early hospital into the larger buildings of 1757. *The prize winners in these lotteries returned their winnings to the Hospital Committee.*

What part have the Irish Sweepstakes of today played in the further history of the Rotunda? The Irish Hospital Sweepstake Commission, in 1933, offered financial assistance to the Rotunda, whose master at that time was Bethel Solomons. This offer was accepted by the Board of Governors.

Under the mastership of Andrew Hope Davidson in 1939–1940 we note in his report on the various improvements and additions for that period that they were made possible by the 160,000 pounds allocated by the Commissioners of the Irish Hospital Sweepstakes, "who also provided for the cleaning of the outside stonework on the front of the main building." This gives an idea of the substantial nature of such gifts to Class A Irish hospitals, which garner all residual proceeds.

In view of the near-insolvency of so many of our own hospitals in these days one cannot but wonder wistfully why such dreams can come true only in Ireland.

(From *M. Times*, January, 1948.)

THE Flex-Straw Corp. (Los Angeles, Cal.) offers a drinking straw which will bend at any angle (even to accommodate the patient who cannot be raised) in place of the ordinary glass drinking tube. It should catch on and become popular.

DR. Ivan W. Brown, Jr., of Durham, N. C., director of The Duke University hospital blood bank and instructor in surgery at the university's school of medicine, has been named assistant technical director of the Red Cross National Blood Program, national headquarters has announced. During World War II Dr. Brown worked with the British Blood Transfusion Service and also served overseas as a member of the surgical staff of the 65th General Hospital. He had charge of the hospital's shock ward and blood bank and also served on the neurosurgical staff. Dr. Brown, who will serve the Red Cross on a part-time basis, was recently appointed a Markle scholar in Medical Science by the Markle Foundation, New York, to do further research work in the field of blood.

THE marked decline in mortality in our country since the turn of the century has naturally been accompanied by an increase in the chances of reaching age 65, the usual retirement age. The prospect of celebrating a 65th birthday was not too bright for a boy born at the beginning of the century, the chances being less than 40 in 100; for a boy born about 1940, the chances had increased to 58 in 100; and by 1945, they were more than 60 in 100. Particular interest attaches to the likelihood that a young man just entering employment will attain retirement age. On the basis of mortality conditions around 1900, a young man 18 years of age had 51 chances in 100 of surviving to his 65th birthday; in 1945 the corresponding figure was 65 in 100. With the improvement in mortality since then, the chances have increased further, so that now the chances are fully two in three that a youth of 18 will live to his retirement age.

Men who already are launched on their careers are very likely to live to the end of their productive life. For example, according to the mortality of the white male population of the United States in 1945, the chances of surviving to age 65 are 70 in 100 at age 45, and 78 in 100 at age 55. These figures, are well above those at the turn of the century.

(*continued on page 44*)

Candy

FOR PRIMING PSYCHOGENIC AND SOMATIC PROCESSES

ALTHOUGH adequate to a nicety, meals can readily lose much of their nutritional function unless prepared and served for gustatory appeal. Drab meals may be refused, denying the patient the benefit of needed nutrients and calories. By virtue of variety of form, color and flavor, candies on the meal tray bring many welcome surprises of satisfaction. Their very presence sets psychogenic and somatic processes into operation which are beneficial to appetite, digestion, and the nutritional state. Rich in concentrated caloric energy and superlative in tastefulness, morsels of candy may give the needed psychogenic therapeutic impulse to inflect upwards the curve of recovery.

Candies are prepared with many valuable foods—milk, butter, eggs, fruits, and nuts. To the extent these foods are present, candies provide biologically adequate protein, appreciable amounts of the important minerals calcium, phosphorus, and iron, and B complex vitamins. Thus candies deserve recommendation whenever the clinical situation at hand permits this gustatory and psychogenic treat.

COUNCIL ON CANDY OF THE NATIONAL Confectioners' ASSOCIATION

1 NORTH LA SALLE STREET • CHICAGO 2, ILLINOIS

Outside the Ivory Tower

(*continued from page 42*)

DAVIS & GECK, INC., Brooklyn, N. Y., have acquired the manufacturing and distribution rights for Tractaclip Wound Approximator for skin wounds, formerly known as the Constant Traction Dressing. Traction is supplied by a sheet of latex connecting two metal members which grip the skin by means of very fine-toothed edges, providing firm anchorage without discomfort. In case of cuts the gentle but continuous traction facilitates approximation of the skin. In plastic surgery of the face and head when the cosmetic effect is important Tractaclip, when indicated, helps to reduce the number of clips or sutures used thus minimizing scar tissue.

IMPROVED technics in the care of mentally ill veterans are enabling Veterans Administration for the first time in many years to discharge about as many patients as it admits to its neuropsychiatric hospitals. Generally, admissions and requests for care exceed the number of patients discharged. However, during a recent ten-month period (July, 1947 through April, 1948) 1,060 more neuropsychiatric patients were discharged from hospitals than were admitted. During this period 51,210 patients were admitted for care and 52,270 were discharged as improved or cured.

For the twenty-two-month period from July, 1946 through April, 1948 a total of 107,579 patients was admitted to hospitals for treatment, compared with 106,694 discharges, or only 885 more admissions than discharges. This is an indication that improved methods of care and establishment of more mental hygiene clinics for out-patient treatment have enabled the Veterans Administration to keep its hospital load of mentally ill from increasing substantially.

DESPITE the devastation wrought by World War II and the resulting depression of living standards, relatively favorable mortality conditions prevail among many European peoples. Western Europe, except Germany, has made a particularly rapid recovery since the end of hostilities. Even though some of the data are not complete and boundary changes and other factors may obscure the actual trends, the available information provides a good basis for appraising the postwar public health picture.

In almost all the countries of Western Europe the death rates in 1946 and 1947 were about equal to or even below the prewar level. The postwar death rate in France is the lowest in her history. The record is very favorable also in England and Wales, the Netherlands, the Scandinavian countries and Switzerland. If account is taken of the aging of the population in these countries, their death rates currently are lower than ever before. In Germany, on the other hand, the postwar death rate is above the prewar level. For Central and Eastern Europe the reports are meager. Czechoslovakia's postwar mortality record is favorable. The published postwar figures for Austria, Rumania and Hungary are at or below the prewar level, but because of doubts as to the reliability of the data it may be concluded only that some degree of recovery has been achieved. Bulgaria, which was little affected by the war, shows no substantial change in the death rate during the war and postwar periods. No recent information is available for Poland, Yugoslavia, the U.S.S.R. or Greece.

From the *Metropolitan Life Insurance Company Bulletin.*

"DO You Know the Story Behind Your Hospital Bill"? a pamphlet designed to inform the layman of the reasons for increased hospital costs, has been published by the Greater New York Hospital Association representing ninety-eight voluntary non-profit hospitals in the metropolitan area. The pamphlet states that although one of every ten citizens is a patient each year in one of New York's hospitals, few realize rising costs of food, fuel and equipment in this inflationary period have been the chief factors responsible for larger hospital bills. Hospital care requires two employees for every patient whereas the finest hotels need only one employee per person. In addition, hospital salaries and wages are at their highest level in history. As a solution to the problem of hospital bills for the person in average circumstances the Hospital Association recommends enrollment in Associated Hospital Service, New York's Blue Cross Plan. A copy of the pamphlet will be given to every patient in New York's voluntary hospitals.

Chronic, traumatic osteomyelitis of several years' duration—extremely malodorous and painful. This is one of hundreds of cases in which the prompt healing induced by Chloresium was reported by well-known clinics.

After treatment with Chloresium Ointment by packing on alternate days for six weeks. This followed "cleaning-up" of infection and malodor by continuous wet dressings of Chloresium Solution (Plain) for initial period of 48 hours.

CHLOROPHYLL HEALED

when other methods of treatment failed

● The case shown above is typical of hundreds, which proved stubbornly resistant to treatment until Chloresium therapeutic, *water-soluble* chlorophyll preparations were used. And the record* shows that an overwhelming majority of them not only responded rapidly to chlorophyll therapy, but healed completely in a relatively short time.

Try Chloresium on your slowest healing case

We invite you to try Chloresium Ointment or Solution (Plain) on your most resistant case—some ulcerative lesion, chronic osteomyelitis, wound, burn, dermatitis, or any other condition which calls for accelerated healing. Just mail the coupon at right.

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*Boehme, E.J.	The Treatment of Chronic Leg Ulcers	The Lahey Clinic Bulletin, 4:242 (1946)
Bowers, Warner F.	Chlorophyll in Wound Healing and Suppurative Disease	Amer. J. Surgery, LXXIII: 37 (1947)
Cady, Jos. B. and Morgan, W.S.	Treatment of Chronic Ulcers with Chlorophyll	Amer. J. Surgery, LXXV: 4 (1948)
Johnson, Harold M.	Dermatologic evaluation	Arch. Dermat. & Sypt. 57:348 (1948)
Langley, W. D. and Morgan, W.S.	Chlorophyll in the Treatment of Dermatoses	Penn. Med. Journal, Vol. 51; No. 1 (1947)
Rafsky, Henry A. and Kreiger, Charles I.	Treatment of Intestinal Diseases with sols. of W. S. Chlorophyll	Rev. Gastroent Vol. 15:549 (1948)

NEW—Chloresium Tooth Paste and Dental Ointment now make chlorophyll therapy available for the treatment of Vincent's infections and other periodontal diseases.

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Physician's package and complete description of the *New Technique* will be sent upon request.

Ethically promoted—
Advertised only to the
medical profession.

Accepted by the Council on Physical Medicine of the American Medical Association.

Easily Fitted—The Lanteen Flat Spring Diaphragm, collapsible in one plane only, is easily placed without an inserter.

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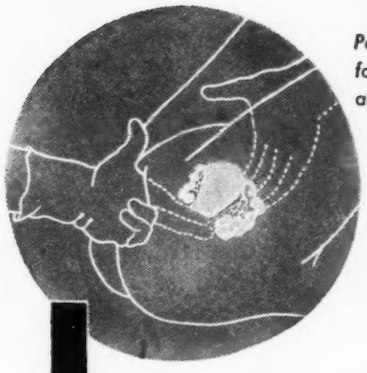

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completes the diagnostic picture...

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Hystero-salpingography with Lipiodol reveals both structural and functional impairment.

A contrast medium of choice because:

1. Firmly-bound 40% iodine in poppyseed oil insures uniform radiopacity.
2. Its viscosity produces clear delineation without excessive "pooling".
3. Exclusive formulation does not involve use of chlorine or its derivatives.
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*Lipiodol is the registered trade-mark for the original product created by Lafay. This product alone can bear the name Lipiodol. Made in the U. S. A. Available in a variety of ampule sizes and 20 cc. multiple dose vials. E. Fougera & Co., Inc., New York, N. Y. Canadian Distributors: Vinant, Ltd., Montreal, Canada.

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Pentobarbital sodium ..... 15 mg.
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The American Journal of Surgery

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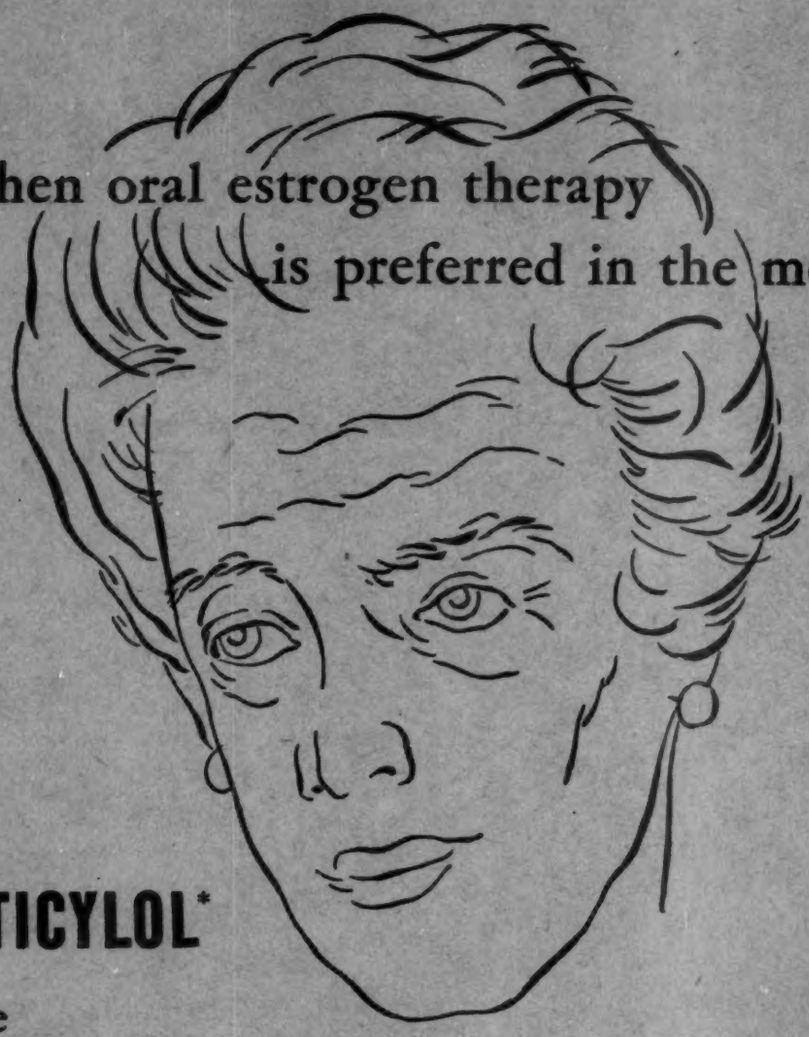
when oral estrogen therapy is preferred in the menopausal patient



ETICYLOL*

the most potent oral estrogen

Eticylol (ethinyl estradiol) readily controls menopausal symptoms making parenteral therapy unnecessary. Only 0.05 mg. t.i.d. is required for initial doses. This may be reduced for maintenance therapy. The "sense of well-being," associated with the use of naturally occurring estrogens, is usually experienced. Few side effects occur in therapeutic doses. Exceptionally low dosage makes Eticylol the most economical steroid estrogen.

ISSUED: Tablets of 0.02 mg. (white) and 0.05 mg. (yellow) – bottles of 100 and 250.

*Formerly Ethinyl Estradiol-Ciba

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ETICYLOL (brand of ethinyl estradiol) Trade Mark

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